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**The Effects of Vulnerabilities and Strengths on the Outcomes of a Chronic Pain
Management Programme**

A thesis
Submitted in fulfilment
of the requirements for the degree
of
Masters of Social Sciences in Psychology
at
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Eryn Campbell



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Abstract

Chronic pain is a problem that affects around one million New Zealanders and is very difficult to treat effectively. Most pain management programmes focus on decreasing levels of treatment outcome measures (pain catastrophising, pain intensity, interference) and increasing levels of pain self-efficacy. Research shows that higher levels of vulnerabilities (depression, anxiety, stress, pessimism) can negatively impact treatment outcomes. However, research also shows that increasing levels of strengths (optimism, hope, spirituality, social support, grit) affect treatment outcomes positively. We wanted to determine if there were differences in treatment outcomes for participants with high levels of vulnerabilities or strengths. Our study looked at the relationships between treatment outcome measures, vulnerabilities, and strengths over a three-week pain management programme. Participants (N = 40) attending the ReCharge Programme at QE Health completed repeat measure scales at intake, discharge, and 12-week follow-up. We found that higher levels of depression, stress, and pessimism were associated with higher levels of pain catastrophising, pain intensity, and interference, and lower levels of pain self-efficacy. Conversely, higher levels of optimism, hope, spirituality, and grit were associated with lower levels catastrophising, intensity, and interference, and higher levels of pain self-efficacy. Anxiety and social support were not associated with any treatment outcomes. We also found that correlations of composite measures of strengths accounted for more variability in pain self-efficacy than did composite vulnerabilities. This suggests that tailored interventions, based on levels of strengths at intake, aimed at increasing levels of strengths during the ReCharge Programme could improve treatment outcome measures for clients.

Keywords: chronic pain, pain management, optimism, hope, spirituality, social support, grit

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The Effects of Vulnerabilities and Strengths on the Outcomes of a Chronic Pain Management Programme

Chronic Pain

One in five New Zealanders lives with chronic pain, that is nearly one million people, and I am one of them. In 2010, I severely damaged my back and in 2012, I underwent surgery to fuse three of my vertebrae together. Unfortunately, in 2013, I was told nothing further could be done. Although the surgery had stabilised my spine it had not had any effect on my pain levels, which were debilitating. In 2014, I attended the ReCharge Programme, a three-week pain management programme, at the Queen Elizabeth Hospital (QE Health) in Rotorua. I found this programme really helpful, however, many people with chronic pain did not see the same positive gains that I did. I became interested in the possible reasons for the notable difference in these outcomes.

Chronic pain is a major problem in New Zealand and abroad, and it is a problem that is only growing worse. The most recent New Zealand Health Survey states that in the New Zealand population prevalence rates of chronic pain have increased from 17% in 2005/6 to 21% in 2015/16 (Cox, 2016). Some of the reasons for the increased prevalence could be due to: our aging population - many elderly people are affected by chronic pain associated with arthritis and cancer (Webster, 2019) - increasing levels of obesity puts extra pressure on joints, and the increased number of hours spent sitting at a desk. Whatever the reason, chronic pain is impacting millions of people, and the impacts are not only related to health but also have a substantial economic effect.

Chronic pain was estimated to cost New Zealand \$13 to \$14 billion in 2016 and Jones (2019) predicted that these figures will rise to \$21 to \$24 billion over the next 30 years. Despite the substantial personal and societal costs of chronic pain there are very few pain management specialists in New Zealand (Jones, 2019). Furthermore, the

complex and subjective nature of chronic pain makes it difficult to treat effectively (Bonica, 1980). Given these limitations, further research needs to be conducted into the most effective ways of treating chronic pain. In order to treat chronic pain, we must first understand what chronic pain is.

A History of Pain Theories

Chronic pain is commonly defined as pain that has persisted for three to six months and/or is present almost every day (Cox, 2016; Kennedy & Abd-Elseyed, 2019; Treede et al., 2015). Acute pain is an essential adaptive function which serves to protect the body from harm, however, chronic pain persists past the point when healing would be expected and causes significant psychological distress and functional impairment (Treede et al., 2019). Pain is more than just a physiological response, it also has psychological, cognitive, and emotional elements. Over the past 200 years, there have been some seminal theories concerning how and why we experience chronic pain. These include the Specificity Theory, the Pattern Theory, the Gate Control Theory, and the Neuromatrix Theory (Trachsel & Cascella, 2019).

In his insightful 1664 manuscript, *Treatise of Man*, Descartes described the dual aspects of pain as a sensory transmission (nociception) and as a perceptual experience (pain) (Descartes, 1664). Descartes conceptualised nerves as tubes conveying motor and sensory information with a gate between the hollow tubes and the brain. This gate could be opened by a tug on the nerve or sensory cue resulting in movement. This theory, however, did not explain how the brain processed the sensory information or why the perceptual experience of pain differed from person to person.

Nearly 150 years later, Charles Bell developed the Specificity Theory in which he postulated that different nerves had different functions (Bell & Shaw, 1868). Rather than conceptualising the brain as a solid homogenous structure, as Descartes had, Bell proposed that messages travelled specific pathways along nerves to the brain depending on the sensation. Bell stated that there were dedicated nerves which travelled to

designated areas of the brain, as if they were a single strand following the pathway from the site of the stimulus to the specific pain reception area in the brain. In contrast, the Pattern Theory of pain suggested by Nafe (1929) stated that it was the pattern of different nerves firing which culminated in the perception of pain. According to the Pattern Theory all nerve endings experienced every different sensory stimulus (heat, cold, pain) which were conveyed to different regions of the brain. The intensity and sensation were then processed according to the pattern they generated in the different regions, which in turn was believed to be perceived as pain. We now know that there are different nerve receptors for different sensations, including a unique receptor for pain (Melzack, 1999).

The Gate Control Theory (Melzack & Wall, 1965) was the first theory of pain to combine aspects of both the Specificity Theory and the Pattern Theory. This new conceptualisation of pain changed the focus of pain research (Moayed & Davis, 2012). Melzack and Wall (1965) proposed that there are two types of nerves: small diameter afferent nerves which transmit pain signals (nociceptive) and large diameter afferent nerves which transmit vibration and touch signals (non-nociceptive). Both types of nerves terminate in the dorsal horn area of the spine in either transmission cells or inhibitory interneurons. Transmission cells carry the pain signal to the brain whereas inhibitory interneurons impede the transmission of the pain signal (Melzack & Wall, 1965). Therefore, increased input from the non-nociceptive nerves can close the gate between the dorsal horn and the brain, effectively cancelling out the input from the nociceptive nerves. Pain signals can travel from the site of the injury to the brain and also from the brain down the spinal cord (Melzack & Wall, 1965). A person's memories, cognitions, and attention related to their pain can all influence pain signals from the brain. Further, Melzack concluded that pain is a complex, multidimensional construct made up of affective, cognitive, sensory, and evaluative components, tying the physiological and psychological theories of pain together.

Due to the explosion in pain research following the release of the Gate Control Theory, many psychological factors previously thought to be the results of pain were now being reassessed as possible causes of pain (Melzack, 2001). The Gate Control Theory proposed that the central nervous system is an integral part of the perception of pain, therefore, the next part of the puzzle to unravel were the neurological mechanisms involved. Melzack (2001) labelled the “neural network, whose spatial distribution and synaptic links are initially determined genetically and are later sculpted by sensory inputs, a ‘neuromatrix’” (p.1378). Melzack also implicated stress as an implicit mechanism in pain, when a person is in pain, they are also experiencing stress which the body seeks to moderate in order to return to a state of homeostasis. The Neuromatrix Theory is complex and multifaceted, incorporating sensory, cognitive, evaluative, affective, discriminative, and stress-regulation systems (Melzack, 2005).

The Neuromatrix Theory integrated many of the physiological and psychological factors that contribute to the perception of pain and is the foundation of the widely favoured biopsychosocial model used today (Seth & de Gray, 2019). When thinking about chronic pain, it is important to understand that there is a difference between the sensations conveyed by nerves (nociception) and the interactions of these sensations with the psychological, genetic, social, and cognitive factors which create the subjective experience of pain (Seth & de Gray, 2019). It appears that nociception does not always create pain nor is it necessary to create the subjective experience of pain, as seen with phantom limb pain, when people experience pain where an amputated limb used to be. Chronic pain is extremely subjective and individualistic, and it has been found that a number of social factors also play a role in its creation and maintenance. A person’s current emotional state, mental health status, history of sexual or physical abuse, culture, occupation, and alcohol and drug misuse can all contribute to chronic pain (Seth & de Gray, 2019).

We now know that the physiology of chronic pain is complex and comprised of several different mechanisms (Trachsel & Cascella, 2019). Sensitisation of peripheral nociceptors, sensory neurons which respond to possible noxious stimuli by transmitting signals to the brain and spinal cord, trigger the activation of central and peripheral sensitisation pathways (Dissanayake & Dissanayake, 2016). Peripheral sensitisation is caused by changes to the peripheral nerve endings at the site of an injury, whereas central sensitisation is enhanced sensitivity in uninjured surrounding areas and is a result of changes in the brain and spinal cord (Vardeh & Naranjo, 2017). The spinal dorsal horn neurons process the sensory information received from afferent nerves and then transmit this information to the central nervous system areas in the brain (Andrew, 2010). When acute pain becomes chronic pain there is potentially a pathogenetic change, meaning the pain ceases to be merely a sensation and instead could be the origination or development of a disease (Nielsen & Henriksson, 2007).

Our understanding of the complex mechanisms that make up the subjective pain experience is now extensive. We know that nociception is not necessary for the sensation of pain. We know that pain can persist past the point where it is adaptive and helpful. And we know that chronic pain causes significant distress and dysfunction in peoples' lives. Despite all of these advances in understanding the physiological underpinnings of chronic pain, there are a number of other factors that can influence the way it is experienced and maintained or can improve or worsen it.

Why is Chronic Pain Difficult to Treat?

We know that there are a number of variables that can contribute to the formation and maintenance of chronic pain, including pain catastrophising, pain intensity, and interference. These factors are often used as treatment outcome measures in pain management programmes, along with pain self-efficacy, how confident a person is that they can do things despite the pain. Furthermore, depression, anxiety, stress, and pessimism appear to be vulnerabilities which increase levels of these treatment outcome

measures (Severeijns et al., 2001). The highly subjective nature of the perception of pain is due to the different levels at which a person experiences each of these variables and the way the variables interact with each other. By integrating the physiological, psychological, and social determinants of chronic pain, clinicians are now able to create holistic pain management programmes tailored to the individual's needs. Despite all of these advances there are still no truly effective treatments for chronic pain (Bonica, 1980). Currently, many pain management treatment plans, including the QE Health ReCharge Programme, attempt to decrease levels of pain catastrophising, pain intensity, and interference and increase levels of pain self-efficacy. We know that treatment outcome measures are often affected by vulnerabilities such as depression, anxiety, stress, and pessimism. However, we also know that there is a growing body of research that suggests strengths such as optimism, hope, spirituality, social support, and grit are associated with changes in treatment outcome measures. Our research intends to determine which vulnerabilities or strengths are associated with the best changes in treatment outcome measures.

Treatment Outcome Measures

Pain Catastrophising

Pain catastrophising occurs when a person has an exaggerated negative schema regarding pain and their ability to cope with pain (Amtmann et al., 2018; Quartana et al., 2009; Sullivan et al., 1995). Schemas are the cognitive frameworks we use to organise and interpret information, in this case pertaining to the actual or perceived threat of experiencing pain. The emotional and cognitive distortions of these schema lead to magnification of the pain intensity sensations, a lack of control over pain related thoughts, and a sense of helplessness in regard to managing the pain (Schütze et al., 2018). Consistent with other factors related to the pain experience, pain catastrophising appears to be a complex, multifaceted construct which is associated with higher levels of pain intensity and distress (Quartana et al., 2009; Sullivan et al., 2001).

Pain catastrophising has been examined for its association with positive (Hood et al., 2012; Pulvers & Hood, 2013) and negative (Schütze et al., 2018; Severeijns et al., 2001) psychological phenomena. People who report higher levels of positive emotions, such as hope and optimism, also report lower levels of pain catastrophising (Ong et al., 2010; Sturgeon & Zautra, 2013). Conversely, people with higher levels of anxiety and depression report higher levels of pain catastrophising. Interestingly, a study by Severeijns et al. (2001) found that pain catastrophising was a better predictor of pain intensity, interference, and psychological distress, than the actual physical impairment. The physical aspect of chronic pain appears to be less important than the psychological aspect when it comes to predicting pain intensity and interference. We therefore need to take other vulnerabilities and possible strengths into account when researching chronic pain management.

Pain Intensity and Interference

The highly subjective nature of pain intensity, how strong the pain feels, creates difficulties when attempting to quantify or measure pain levels (Dansie & Turk, 2013). The perceived intensity of sensation can influence a person's thoughts and emotions about what they are capable of doing (Arnstein et al., 1999). Pain interference is conceptualised as the degree to which a person's pain interferes with their functioning in day-to-day life (Wilson, 2014). Interestingly, just the fear of increasing pain intensity appears to be related to the degree of interference to daily life, the more a person fears their pain intensity increasing, the less capable they feel (Costa et al., 2011). In other words, the more people believe that their pain causes disability, the more disabled they become (Arnstein et al., 1999). If this is the case, then it would appear that attempting to lower a person's level of perceived pain intensity is more suited to a psychological approach than a physiological one. Reducing levels of treatment outcome measures such as pain catastrophising, pain intensity, and interference, is important in chronic pain management.

There is also a measure that pain management programmes attempt to increase, pain self-efficacy.

Pain Self-efficacy

Pain self-efficacy refers to a person's confidence in their ability to perform tasks despite their pain (Nicholas, 2007). In chronic pain clients, higher levels of pain self-efficacy are often associated with lower levels of avoidance behaviours and disability (Arnstein, 2000; Arnstein et al., 1999; Asghari & Nicholas, 2001; Costa et al., 2011). Pain self-efficacy can mediate the relationship between chronic pain and depression (Arnstein et al., 1999) and strongly predicts pain intensity and disability levels (Meredith et al., 2006).

A study conducted by Asghari and Nicholas (2001) with 145 chronic pain sufferers over a 9-month period demonstrated the importance of pain self-efficacy as a predictor of depression, disability, and pain intensity. Interestingly, although the participants were also undergoing medical treatment throughout the study, those with low pain self-efficacy levels at baseline saw only minimal improvements in comparison to those with high pain self-efficacy levels. Therefore, increasing a person's sense of pain self-efficacy appears to be a necessary component for pain management programmes seeking improvements in levels of pain catastrophising, pain intensity, and interference. There are also a number of vulnerabilities which contribute to these treatment outcome measures, such as depression, anxiety, stress, and pessimism.

Vulnerabilities

Depression

When looking at treatment outcome measures, we know that elevated levels of depression, anxiety, and stress are common among people living with chronic pain (Bair et al., 2008; Tsang et al., 2008). Furthermore, the prevalence of depression in a chronic pain population appears to be higher than in populations with other chronic medical

conditions such as arthritis or heart disease (Bair et al., 2008; Banks & Kerns, 1996). Banks and Kerns (1996) offer a number of possible reasons for this disparity. Firstly, the subjective sensation of pain is extremely aversive, in both its chronic and acute forms. One of the defining features of chronic pain is that it is present nearly every day, whereas acute pain comes and goes. Thus, even though other medical conditions also experience pain it is more likely to be acute and episodic. Another defining feature is that it is pain that has lasted for more than six months. Although other medical conditions can also last for more than six months, there is normally also a way to treat the condition medically, which is not available for chronic pain sufferers. This inability of medical science to offer a solution can lead to feelings of hopelessness and despair. This would suggest that it is not solely the experience of pain, nor the chronicity of a condition, that leads to higher rates of depression. Finally, a person living with chronic pain will often feel that they are no longer able to take part in activities that previously brought them pleasure. The fear of increasing pain intensity leads to a decrease in activity, which is then reinforced because it does not increase pain intensity. By avoiding these activities, the person is not only denying themselves the opportunity to disprove this fear as unrealistic, but they are also not receiving the positive reinforcement which occurs with pleasurable physical and social activities, or with meaningful engagement such as employment. Depression alone can be debilitating; however, we know that depression is seldom found in isolation, it is often co-morbid with anxiety.

Anxiety

The combination of chronic pain, depression, and anxiety is correlated with higher levels of pain intensity and disability. In a study of 500 chronic pain clients, Bair et al. (2008) found that 54% (n=271) of participants reported only chronic pain. Chronic pain and anxiety was reported in 3% (n=15) of the sample and chronic pain and depression was reported by 20% (n=98). Overall, 23% (n=116) of participants reported both depression and anxiety, on top of their chronic pain. Anxiety tends to increase when a

person is feeling threatened, whether through the thought of psychological or physical danger. Pain related anxiety is more specific to the domains of chronic pain such as fear of increased pain, avoidance of activities, and fearful worry about the pain (McCracken & Gross, 1998). This anxiety in turn leads to greater focus on the pain itself manifesting as increased pain catastrophising, pain intensity, and interference.

Stress

Chronic stress and chronic pain appear to activate similar neural pathways, specifically the hypothalamo-pituitary-adrenal (HPA) axis (Blackburn-Munro & Blackburn-Munro, 2001). Stressors attached to the experience of chronic pain can include worry about long term employment, financial strain, and strain on relationships. These stressors then lead to an overactivation of the body's stress response in the HPA axis. The HPA axis is also implicated in the body's response to painful sensations. Although it is still unclear whether there is a causal relationship between stress and pain in the brain's neurology, elevated stress levels are often seen in people living with chronic pain (Abdallah & Geha, 2017). More importantly perhaps are the behavioural similarities between the two processes, the inability to return the body to a state of homeostasis following physical or psychological stress. The focus of much chronic pain research today is on whether there are neurological connections between the psychological and physiological stress components that are part of the chronic pain experience. Neuroscientific research is outside the scope of this paper, but it is an exciting field of research that will be worth watching.

Pessimism

People who are pessimistic tend to expect bad experiences rather than good ones (Schier et al., 1994). The more pessimistic a person is, the higher they rate their pain symptoms such as pain intensity and interference (Baker, 2007; Bargiel-Matusiewicz & Krzyszkowska, 2009; Robinson-Whelen et al., 1997; Scheier & Carver, 1987). Higher levels of pessimism are also associated with higher levels of stress. People with high

levels of pessimism have a tendency to use more dysfunctional modes of coping such as denial and distancing. Overall, the literature appears to suggest that optimists and pessimists are probably doing things differently to achieve such different pain related outcomes (Scheier et al., 1986).

When looking at pessimism and optimism, lower levels of pessimism is not equivalent to higher levels of optimism (Robinson-Whelen et al., 1997). These are two related, but separate, constructs. Likewise, decreasing levels of depression is not the same as increasing levels of hope. Therefore, we should not only focus on decreasing levels of vulnerabilities, but it may also be helpful to focus on increasing levels of strengths. There are several strengths that contribute to changes in levels of pain catastrophising, pain intensity, interference, and pain self-efficacy.

Strengths

Optimism

Optimism is broadly defined as an overall belief that more good things than bad will happen to a person (Scheier & Carver, 1985). More importantly for this study, the more optimistic a person is, the lower they subjectively rate their pain intensity, interference, and disability levels (Baker, 2007; Bargiel-Matusiewicz & Krzyszkowska, 2009; Robinson-Whelen et al., 1997; Scheier & Carver, 1987). Moreover, optimism is one of the few positive traits that has been shown to reduce experimentally induced pain intensity (Geers et al., 2008; Hanssen et al., 2014). Higher levels of optimism are also associated with lower levels of stress.

People with higher levels of optimism appear to use different, more effective, coping strategies when it comes to dealing with chronic pain (Scheier & Carver, 1985; Scheier et al., 1986). When not facing any health concerns, optimists can be rather blasé about health issues. However, when faced with a specific health problem, optimists appear to move into a more adaptive mode whereby they begin to use problem-focused

coping strategies, acceptance and resignation, or positive reinterpretation (Scheier et al., 1986).

Hope

Hope and optimism, although both contributing to physical and psychological well-being, are two separate constructs (Alarcon et al., 2013; Schier et al., 1994). Where optimism is a general positive view about one's future, hope is defined as the cognitive process behind a person's agency "successful determination in meeting past, present, and future goals" and pathway "being able to generate successful plans to meet goals" (Snyder et al., 1991, p. 570). In relation to chronic pain, people with high levels of hope appear to have a higher tolerance for pain and lower reported levels of pain intensity (Berg et al., 2008).

Maintaining high levels of hope while living with chronic pain is often hard due to the pervasive nature of chronic pain (Larsen et al., 2015). A meta-analysis of psychological interventions for chronic pain found that a person's attitudes, beliefs, and expectations about their pain was one of the most important therapeutic components when looking at treatment outcome measures (Hoffman et al., 2007). Thus, increasing a person's levels of hope should have a positive impact on their overall well-being and self-efficacy while decreasing levels of pain intensity and interference. The goal-oriented focus of hope can be construed as an active adaptive strategy, however, hope without action can be considered a passive maladaptive strategy similar to prayer (Ashby & Lenhart, 1994).

Spirituality

Spirituality is becoming an important construct for health professionals to consider in the provision of mental and physical health care services (Egan et al., 2011). There are many different definitions of spirituality, which makes it difficult to synthesise the research. Rippentrop et al. (2005) found that many people living with chronic conditions, including chronic pain, use spirituality as a tool to help them cope with their condition. In Rippentrop

et al.'s study spirituality was measured with the Brief Multidimensional Measure of Religiousness/ Spirituality (BMMRS). This is broken into 11 dimensions; daily spiritual experiences, values/beliefs, forgiveness, private religious practices, religious and spiritual coping, religious support, religious/spiritual history, commitment, organisational religiousness, religious preference, and overall self-ranking

Delaney (2005) created The Spirituality Scale, a spirituality/self-awareness scale that did not rely on organised religion as a base. Factor analysis left her with three subscales; self-discovery, relationships, and eco-awareness. These subscales can be used in a practical way in health care to monitor and foster spiritual wellbeing. For example, a person with a low score in the self-discovery subscale could be taught some simple self-reflection tools such as mindfulness meditation to uncover their existential self (Delaney, 2005). The practical and areligious theoretical underpinning of this measure make it a potentially useful tool in measuring spirituality in chronic pain clients and it was the scale we used in our research.

There is an interesting contradiction in the literature on the relationship between spirituality and chronic pain. There is no clear consensus as to whether spiritual practices and beliefs (as measured with the BMMRS) help or hinder people living with chronic pain (Rippentrop et al., 2005). A study by Ashby and Lenhart (1994) found that people who scored high on use of prayer, as measured with the Coping Strategies Questionnaire, also scored high on pain intensity and disability. They suggested that the use of prayer as a pain management strategy could be a maladaptive coping mechanism similar to avoidance (Ashby & Lenhart, 1994). Naturally these data do not suggest that prayer causes physical pain. A possible explanation for these findings could be that as peoples' levels of physical discomfort grows so does the tendency to engage in prayer. It may also be that encouraging people living with chronic pain to focus on their self-awareness and relationships, with people and the environment, is more adaptive than encouraging reliance on prayer. People may also find that belonging to a spiritual community, such as

a church, may provide a source of social support, which is also a topic that may or may not be helpful in chronic pain management.

Social Support

Social support is another strength with conflicting results as to whether it is helpful in the management of chronic pain. López-Martínez et al. (2008) found that social support is associated with lower levels of depression and pain intensity, however, they also found that higher levels of support and attention from a spouse or intimate partner was associated with increased levels of pain behaviours (grimacing, limping) and increased levels of pain intensity. A meta-analysis conducted by Che et al. (2018) of 21 studies (N=1379) found that interaction with a stranger was associated with lower levels of physiological arousal caused by pain, while interaction with an intimate partner or close friend was associated with higher levels of physiological arousal. Thus, it is not inconceivable that the way in which your spouse or intimate partner communicates with you regarding your pain could actually be unintentionally contributing to overall pain outcomes.

On the other hand, broader measures of perceived social support (social networks, resources, and support from others) were found to predict lower levels of disability and pain intensity at three and five year follow up (Evers et al., 2003). Thus, the available literature suggests that social support can be beneficial or detrimental depending on the context. Our research was interested in the broader patterns of social support and did not ask whether participants had a spouse or intimate partner. Rather, we wanted to know whether participants perceived that they were generally well supported in their day to day lives, for example, did they have support if they ended up sick in bed.

Grit

Grit is defined as perseverance and passion for long-term goals, even in the face of adverse life events, and is associated with higher quality of life for chronic pain clients (Trainor et al., 2019). Most of the literature on grit is around successful academic or

occupational performance, however, we have recently seen a shift with new research investigating the links between grit and chronic pain (Buckingham & Richardson, 2020; Sharkey, 2017; Traino et al., 2019). According to Duckworth et al. (2007), a person with grit is more likely to stick to long term plans, despite setbacks and failures. Given some of the unique challenges of treating chronic pain it may be helpful to understand how gritty a person is.

Grit is generally discussed as it relates to a long-term, often highly valued, goal such as years spent training on a musical instrument in order to gain a place in an orchestra. When applied to chronic pain management the long-term goal may be highly valued, for instance lower pain intensity, but not something a person is passionate about achieving. A person with higher levels of grit would therefore need to exhibit greater self-control around necessary, but possibly unpleasant, tasks (such as exercising), despite the pain.

Chronic pain management requires a multi-pronged approach which incorporates physical, psychological, and social interventions. Most pain management programmes are focused on decreasing levels of treatment outcome measures such as pain catastrophising, pain intensity, and interference, while increasing levels of pain self-efficacy. This goal is often complicated by clients presenting with depression, anxiety, stress, and pessimism, which can act as vulnerabilities that may negatively impact their treatment outcome measures. However, we know that chronic pain can also be influenced by many different strengths. For example, optimism is associated with lower levels of pain intensity, interference, and disability (Goodin & Bulls, 2013), while hope is associated with higher tolerance for pain, lower pain intensity, and less interference (Snyder et al., 2005). Spirituality/self-awareness may be associated with self-discovery, acceptance, and the importance of relationships (Delaney, 2005), likewise, social support has been associated with lower levels of depression, pain intensity, interference, and disability (Evers et al.,

2003). Finally, grit may play a role in decreasing disability caused by interference (Sharkey, 2017).

What we do not know is which of these vulnerabilities and strengths may have the largest effect on treatment outcome measures when we analyse all of them at the same time. Which of them may be more salient to focus on when designing individualised treatment plans such as the ReCharge Programme? What we still need to research are the relationships between *treatment outcome measures* (pain catastrophising, pain intensity, interference, and pain self-efficacy), *vulnerabilities* (depression, anxiety, stress, and pessimism), and *strengths* (optimism, hope, spirituality, social support, and grit). In an attempt to shed some first light onto these important issues, we turn to our research questions.

1. Did the participants see statistically significant changes in the treatment outcome measures, vulnerabilities, and strengths during the three-week ReCharge Programme from intake to discharge?
2. Were there any associations between the treatment outcome measures, vulnerabilities and strengths?
3. Did the vulnerability and strength measures have any predictive power on the treatment outcome measures?
4. Were there any long-term effects of the treatment outcome measures at follow-up?

Based on the literature we predicted that participants would see significant changes in the treatment outcome measures from intake to discharge and that there would be negative correlations between levels of vulnerabilities and pain catastrophising, pain intensity and interference and a positive correlation between levels of vulnerabilities and pain self-efficacy. Conversely, we predicted that there would be positive correlations between levels of strengths and levels of pain catastrophising, pain intensity, and

interference and a negative correlation between levels of strengths and pain self-efficacy.

We would expect that depression, anxiety, optimism, and hope would have predictive power on the treatment outcome measures based on the literature.

Method

Participants

Participants experiencing chronic pain were sourced from the QE Health ReCharge Programme - a 3-week in-client pain management and rehabilitation programme (see Appendix A). All clients who received treatment between the dates of 1st January 2020 and 31st November.2020 were invited to take part in this research. 74 clients (61 female, 13 male) completed the intake survey, however unfortunately, the Level 3 and 4 COVID-19 lock down in New Zealand from the 24th of March 2020 to the 14th of May 2020 meant that 31 of these participants were unable to complete the ReCharge Programme. Of the remaining 43 participants, three returned incomplete data and were excluded from the study. This left us with 40 participants (35 women and five men, mean age at intake 45.66years, SD = 15.907). Of the 40 participants, only 14 also returned surveys at 12-week follow-up (14 women, mean age at intake 44.6 years, SD = 15.520).

Design

In a within-subjects design, each participant completed self-report scales when they began the ReCharge Programme (Intake). They completed the same self-report scales three weeks later when they had completed the programme (Discharge), and again at 12-weeks (Follow-up). Our repeated measures was Time: Intake (1), Discharge (2), and Follow-up (3). Our dependent variables were self-report measures of:

Treatment outcome measures: Pain catastrophising, pain intensity, interference, and pain self-efficacy. Vulnerabilities: Depression, anxiety, stress, and pessimism. Strengths: Optimism, hope, spirituality, social support, and grit.

Statistical Procedures

In order to answer the first research question, descriptive statistics (means, standard deviations, and 95% confidence intervals) were calculated for Intake, Discharge, and Follow-up for each variable and then graphed via boxplots. Related samples t-test

(Intake vs Discharge), including effect sizes, were then calculated for each dependent variable. Associations between dependent variables were then assessed via Pearson's correlations to answer our second research question. Multiple regressions were performed to answer our third research question in order to examine how much each vulnerability and strength influenced the treatment outcome measures (% of variance accounted for). Finally, any long-term effects were assessed in the Follow-up period (12 weeks after Discharge). Fourteen participants provided full data sets for this part of the study (our fourth research question).

All inferential statistics were calculated using IBM SPSS Statistics 25. When treating the data, the decision was made that if an entire scale was missing for a participant these data were excluded from the analysis. Missing data was changed to the sample mean for the particular scale if there was only one missing data point.

Ethical Considerations

Ethics approval for this project was granted by the Human Research Ethics Committee (Appendix B) All clients took part in the ReCharge Programme, regardless of participation in the research. Clients self-selected themselves (or not) as participants as part of the intake procedure on the first day of the ReCharge Programme. Those who chose to take part were offered the opportunity to drop out of the study at any time by simply not completing the scales. Data collected was anonymised to protect privacy and stored on a secure server with password protection.

Treatment Outcome Measures

The following scales are those that QE Health require their clients to complete before and after taking part in their ReCharge Programme. None of these scales were altered for this study.

Pain Catastrophising

The Pain Catastrophising Scale (PCS; Appendix D) is a 3-factor tool which measures rumination, magnification, and helplessness (Sullivan et al., 1995). Participants responded to items about the degree to which they have thoughts and feelings when they are experiencing pain on a 5-point Likert scale (0 = *not at all* to 4 = *all the time*). Examples of the items include “I keep thinking about how to badly I want the pain to stop” and “I wonder whether something serious may happen”. The coefficient alpha for the composite PCS scale is .87 (Cronbach, 1951). The PCS composite scores range from 0 – 52 and are calculated by summing the responses to the 13 items (Sullivan, 2009).

Pain Intensity and Interference

The Brief Pain Inventory for Chronic Non-malignant Pain (BPI; Appendix E) was used to evaluate two distinct factors; pain intensity and the degree to which pain interferes in everyday activities for people living with chronic pain (Tan et al., 2004). Participants responded to each item on an 11-point Likert scale (0 = *no pain* to 10 = *pain as bad as you can imagine*) about the intensity levels of their pain. There are four categories for the pain intensity scale; the worst intensity in the last week, the least intensity in the last week, your pain on average, and how much pain do you have right now. The pain intensity composite score ranges from 0 – 40 and are calculated by summing the responses to the four items. The pain interference scale is designed to measure impairment in functioning caused by pain in seven different areas: general activity, mood, walking ability, normal work, relations with other people, sleep, and enjoyment of life. This is also measured on a Likert scale (0 = *does not interfere* to 5 = *interferes completely*). The pain interference composite score ranges from 0 – 50 and are calculated by summing the responses to the seven items. Factor analysis confirms that the two factors are independent and shows acceptable internal consistency for both the intensity ($\alpha = .85$) and the interference (Cronbach's $\alpha = .88$) (Tan et al., 2004).

Pain Self-efficacy

The Pain Self-Efficacy Questionnaire (PSEQ; Appendix F) is a 10-item measure of confidence in one's ability to complete tasks despite the pain for people experiencing ongoing chronic pain, for example "I can enjoy things, despite the pain" (Nicholas, 2007). Participants responded to each item on a 7-point Likert scale (0 = *not at all confident* to 6 = *completely confident*). The PSEQ has excellent internal consistency ($\alpha = .92$) and good test-retest reliability (Tonkin, 2008). PSEQ scores are useful for determining clinically significant levels of functioning in chronic pain clients, including predicting risk of depression and disability and rehabilitation outcomes. A composite score of 0 - 60 is calculated by summing all items. QE Health included the PSEQ in the data they collected, therefore, this was not incorporated into the Chronic Pain Wellbeing Scale but measured as a separate positive factor.

Measures of Vulnerabilities

Depression, Anxiety, and Stress

The Depression Anxiety Stress Scale – 21 (DASS-21; Appendix G) is a set of three self-report scales consisting of seven items each (Lovibond, 1995). Examples of the items include depression "I found it difficult to work up the initiative to do things", anxiety "I was aware of dryness of my mouth", and stress "I felt that I was using a lot of nervous energy". Participants responded to each item on a 4-point Likert scale, (0 = *did not apply to me at all* to 3 = *applied to me very much or most of the time*). The DASS-21 has been shown to have adequate construct validity and high reliability ($\alpha = <.70$) for all the subscales according to Nunnally (1994); depression ($\alpha = .88$), anxiety ($\alpha = .82$), and stress ($\alpha = .90$) (Cronbach, 1951). It also displays sufficient discrimination between the three scales (Henry & Crawford, 2005). The DASS-21 has good convergent and discriminant validity when compared with other measures of anxiety, depression, and stress. The DASS-21 composite scores range from 0 – 21 and are calculated by summing the responses to the seven items in each subscale.

Pessimism

Pessimism was measured using The Life Orientation Test Revised (LOT-R; Appendix H), which also measures optimism. Although related, pessimism is not merely the opposite of optimism, it is a separate construct and is explained below (see Optimism).

Measures of Strengths

Strengths were measured with the Chronic Pain Wellbeing Scale (Appendix M), a scale created by merging well validated measures for optimism and pessimism, hope, spirituality, social support, and grit. These scales were merged at the request of QE Health for ease of use and brevity as participants are already required to complete pages of paperwork. In order to make the form as simple as possible the same responses were listed for all questions. The responses for all scales were changed to a 5-point Likert scale (1 = *very much like me* to 5 = *not like me at all*). These responses were identified as being suitable for all questions in the Chronic Pain Wellbeing Scale after peer review. The following five scales were incorporated into the Chronic Pain Wellbeing Scale

Optimism

The Life Orientation Test Revised (LOT-R; Appendix H), is a 10-item measure of optimism “In uncertain times, I usually expect the best”, and pessimism “If something can go wrong for me, it will” (Schier et al., 1994). Of the 10 items, the three items measuring pessimism and the three items measuring optimism were used. Four items used as fillers intended to disguise the purpose of the scale were not included in the Chronic Pain Wellbeing Scale (Goodin & Bulls, 2013). Responses were changed from a 5-point Likert scale (A = *I agree a lot* to E = *I disagree a lot*) to a 5-point Likert scale (1 = *not much like me* to 5 = *very much like me*). The test-retest reliability for the LOT-R and concurrent validity has been established, as has the internal validity ($\alpha = .78$) (Schier et al., 1994). A composite score (0 – 15) for the optimism scale is calculated by summing items 1, 4, and

10. A composite score (0 – 15) for the pessimism scale is calculated by summing items 3, 7, and 9.

Hope

The Adult Trait Hope Scale (ATHS; Appendix I), is made up of 10 items comprising two subscales; pathway “I can think of many ways to get the things in life that are important to me.” and agency “I’ve been pretty successful in life.” (Snyder et al., 1991). Six items were used from the ATHS, four questions described by the scale’s creator as “fillers” which do not contribute to the overall score were not used in the Chronic Pain Wellbeing Scale (Babyak et al., 1993). Responses were changed from an 8-point Likert scale (1 = *definitely false* to 8 = *definitely true*) to a 5-point Likert scale (1 = *not much like me* to 5 = *very much like me*). The Adult Trait Hope Scale has acceptable internal reliability (Cronbach’s $\alpha = .70$ to $.80$), demonstrates convergent and discriminant validity, and has test-retest coefficients ranging from $.70$ to $.80$ (Babyak et al., 1993). Scores are calculated by summing items 1, 2, 4, 6, 8, 9, 10, and 12 giving a composite Hope Scale score ranging from 0 – 40.

Spirituality

The Spirituality Scale (SS; Appendix J) is a 23-item scale designed to measure intuitions, beliefs, lifestyle choices, rituals, and practices related to spirituality (Delaney, 2005). The SS has high internal consistency ($\alpha = .94$) with the three subscales ranging from $.81$ to $.94$. For the sake of brevity, the original scale was cut to 10 questions based on the factor analysis for each subscale. Examples of the remaining items include “I have a sense of purpose” and “I am able to receive love from others”. Responses were changed from a 6-point Likert scale (1 = *strongly disagree* to 6 = *strongly agree*) to a 5-point Likert scale (1 = *very much like me* to 5 = *not like me at all*). Scores were calculated by summing all items, with a composite score (0 – 50).

Social Support

The Duke-UNC Functional Social Support Questionnaire (FSSQ; Appendix K) was designed to measure the functional social support people perceived that they received in life (Broadhead et al., 1988). Example questions include “I get a chance to talk to someone I trust about my personal or family problems” and “I have people who care what happens to me”. Responses were changed from an 8-item Likert scale (1 = *much less than I would like* to 5 = *as much as I would like*) to a 5-item Likert scale (1 = *very much like me* to 5 = *not like me at all*). All eight questions from the FSSQ were used in the Chronic Pain Wellbeing Scale. The FSSQ displays very good discrimination for each of the scales, with item-total correlation scores of .62 for confident support and .64 for affective support (Broadhead et al., 1988). A composite score (0 – 40) is calculated by summing all items.

Grit

All items in The Short Grit Scale (GRIT-S; Appendix L) were used. GRIT-S is an 8-item Likert scale (1 = *very much like me* to 5 = *not like me at all*) measuring trait perseverance and a person’s passion for achieving long-term goals (Duckworth & Quinn, 2009). Items are split between two subscales; consistency of interest “New ideas and projects sometimes distract me from previous ones” and perseverance of interest “I finish whatever I begin”. The GRIT-S displays acceptable internal consistency ($\alpha = .73$ to $.83$). The GRIT-S has been shown to be relatively stable over time with good test-retest reliability (Duckworth & Quinn, 2009). A composite score (0 – 40) is calculated by summing all items.

Procedure

All clients attending the QE Health ReCharge Programme were given the opportunity to take part in this research project. Those who chose to participate were given the Chronic Pain Wellbeing Scale to complete along with the scales to be completed for the ReCharge Programme. These scales were repeated at three different

time points: day of admission to the ReCharge Programme, day of discharge from ReCharge Programme after three weeks, and 12-week follow-up. There was no face-to-face interaction between potential participants and the researcher, and all scales were self-report measures. Contact with participants was initiated by the ReCharge Programme staff and all participants signed a consent and information form (Appendix C). The only sociodemographic characteristics collected were age and gender.

Results and Discussion

Research Question 1

Our first research question was: Did the participants see statistically significant changes in the treatment outcome measures, vulnerabilities, and strengths during the three-week ReCharge Programme from intake to discharge?

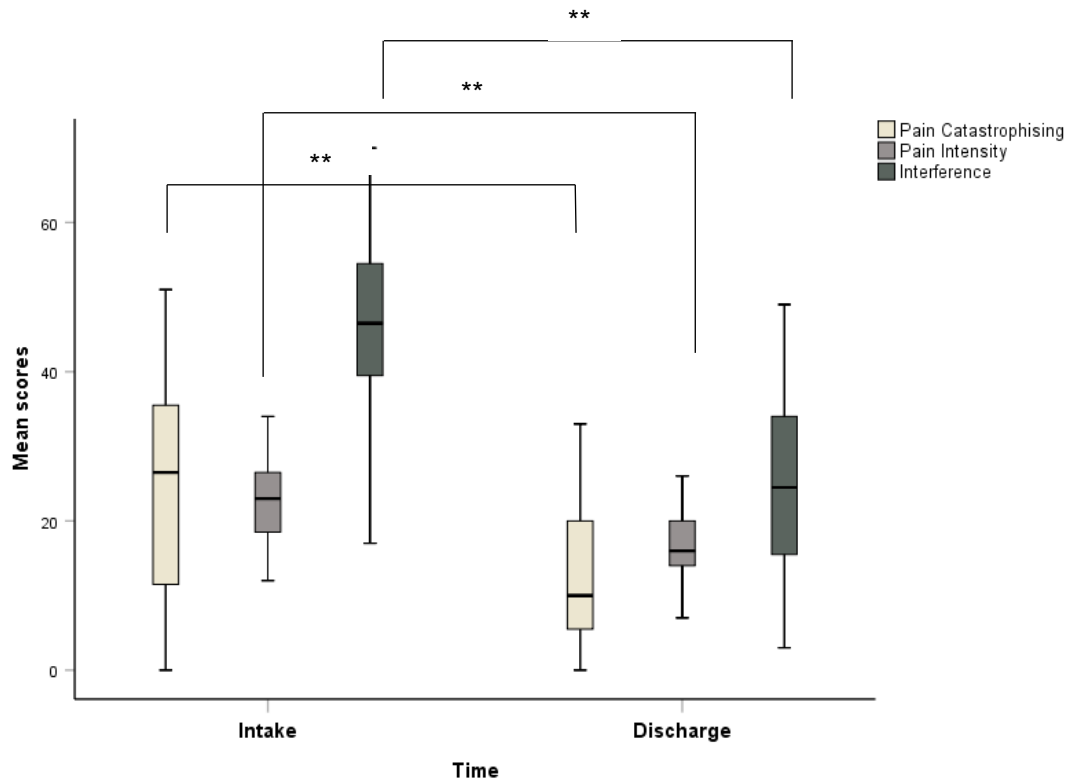
Results

In order to answer this question, we first calculated the mean and variability scores for all variables at intake and at discharge three weeks later (see Table 1 for descriptive statistics). We then created box plots depicting means (horizontal line within the boxes and 25% and 75% percentiles, lower and upper boundaries and with 95% confidence intervals (error bars) for treatment outcome measures, pain catastrophising, pain intensity, and interference (Figure 1), pain self-efficacy (Figure 2), vulnerabilities, depression, anxiety, stress, and pessimism (Figure 3), and strengths, optimism, hope, spirituality, social support and grit (Figure 4).

We checked that we met the assumptions for paired samples t-tests. Firstly, our dependent variable (time) was a continuous variable, and secondly, our independent variables consisted of two or more categories (intake, discharge, and follow-up). However, there were some outliers as assessed by boxplot which were modified to the largest or smallest data value that was not an outlier. Once the outliers had been modified, we determined that the data was normally distributed as assessed by the Shapiro-Wilk's test ($p > .05$). The assumption of normality was not met for pain catastrophising or pain intensity as assessed by the Shapiro-Wilk's test ($p = .018$ and $p = .038$ respectively). As the paired samples t-test is considered to be relatively robust when it comes to violations of normality the decision was made to run the analyses anyway (Fradette et al., 2003).

Figure 1

Boxplots for Mean Treatment Outcome Measures (Intake and Discharge)



Note: $N = 40$. Box plots indicating mean scores, 25% and 75% percentiles for the outcome measures pain catastrophising, pain intensity, and interference at intake and discharge. * = $p < .05$, ** = $p < .01$. The error bars indicate 95% confidence intervals.

As we can see in Figure 1, the biggest change was in levels of interference, followed by pain catastrophising and then intensity. As the p value for all three pairs was less than .000, we decided there was no need to run a Bonferroni post hoc calculation for the treatment outcome measures.

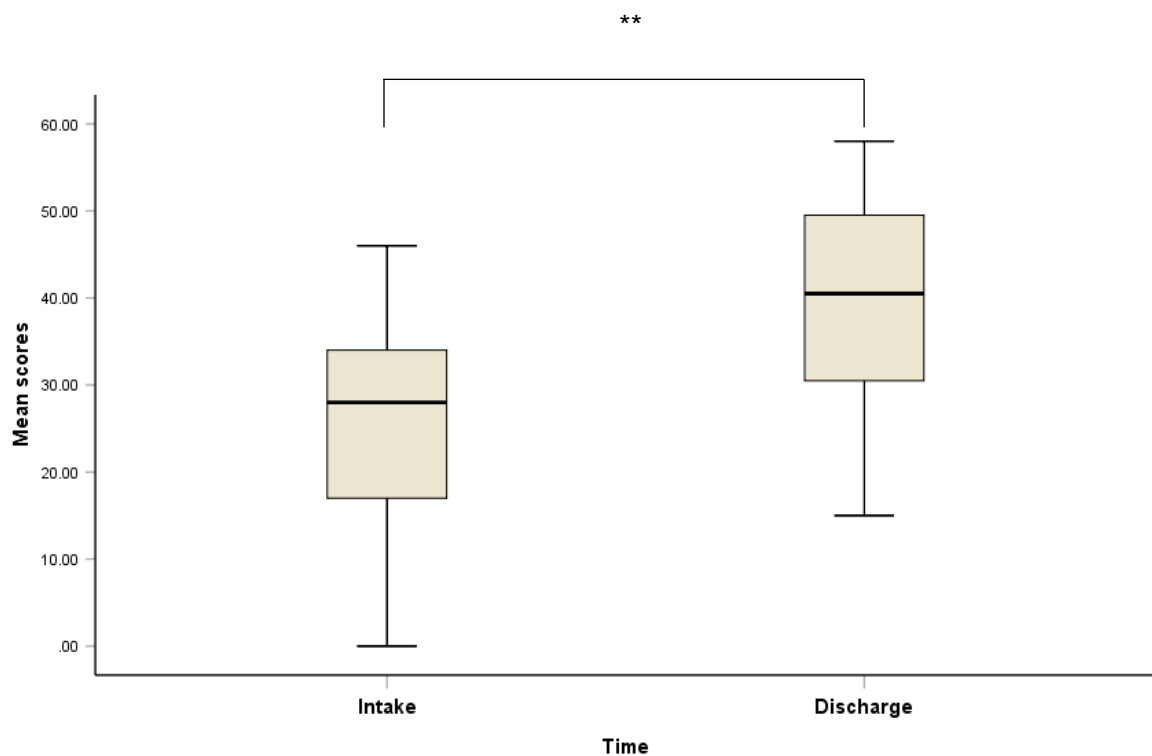
Participants saw a highly significant decrease in pain catastrophising from intake to discharge ($t(39) = 5.827$, $p < .000$, $d = .921$, large effect size). They also saw a highly significant decrease in pain intensity ($t(39) = 7.292$, $p < .000$, $d = 1.153$, large effect size) and in interference ($t(39) = 9.945$, $p < .000$, $d = 1.573$, large effect size).

Figure 2 shows that participants' levels of pain self-efficacy increased from intake to discharge. Inferential statistics (paired samples t-tests) confirmed that the differences in levels of all treatment outcome measures, including pain self-efficacy, from intake to discharge were statistically highly significant.

Participants saw an increase in pain self-efficacy from intake to discharge ($t(39) = -8.094$, $p < .000$, $d = -1.280$, large effect size).

Figure 2

Boxplots for Mean Pain Self-efficacy (Intake and Discharge)

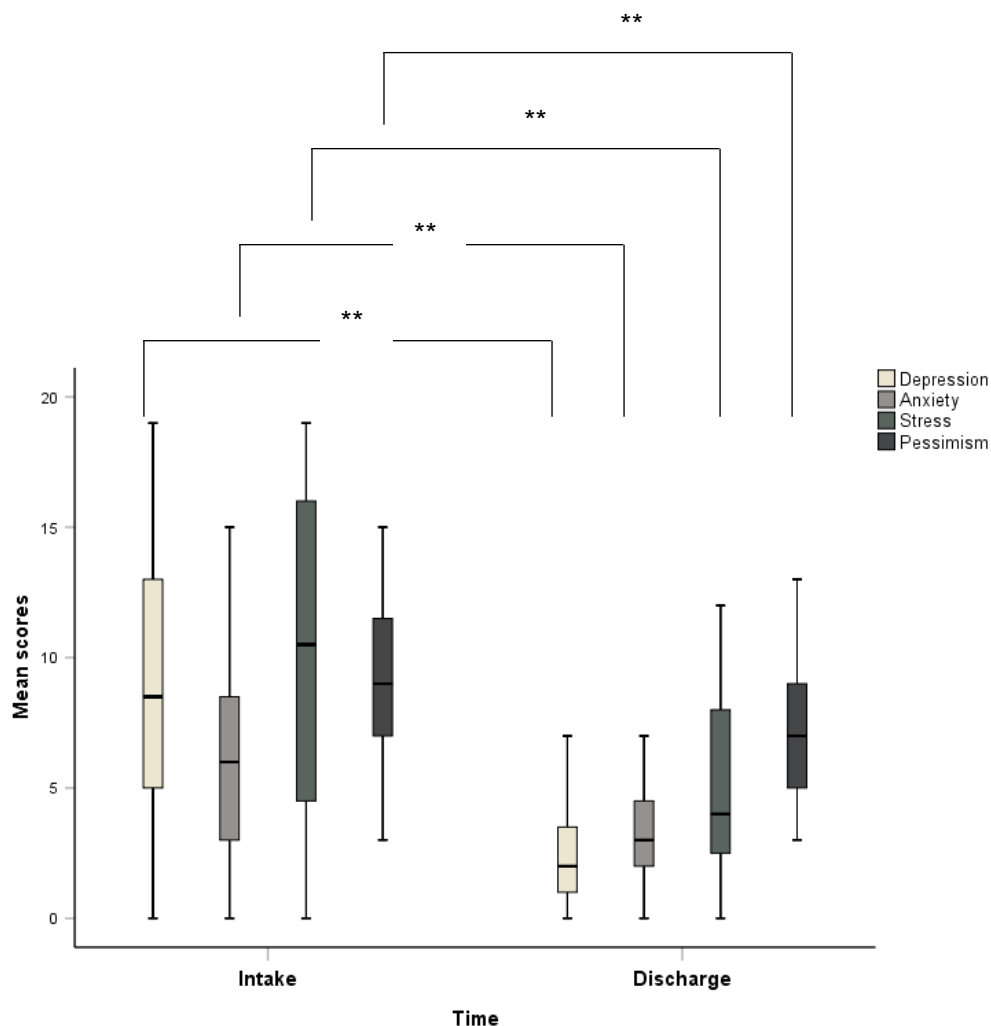


Note: $N = 40$. Box plots indicating mean scores, 25% and 75% percentiles for the outcome measure pain self-efficacy at intake and discharge. * = $p < .05$, ** = $p < .01$. The error bars indicate 95% confidence intervals.

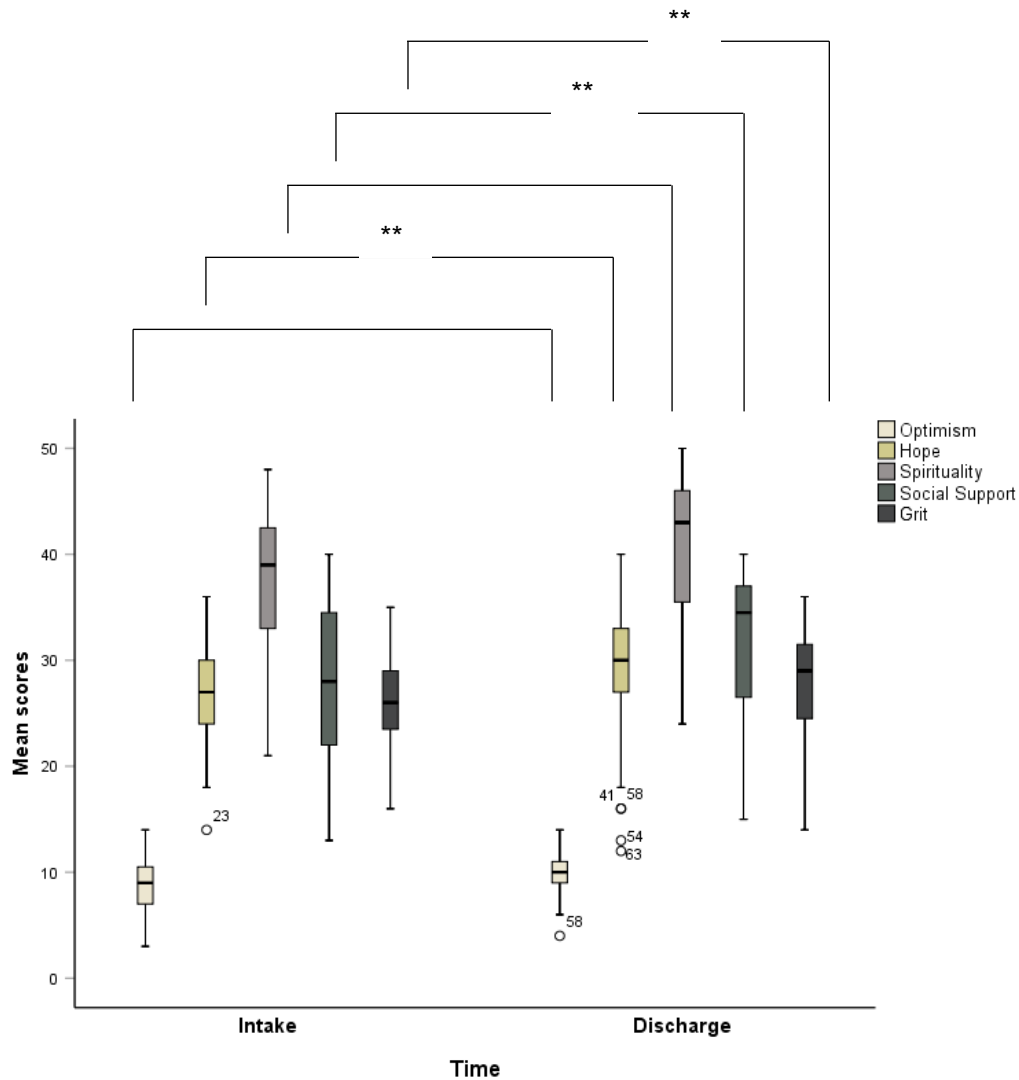
Figure 3 shows that participants saw a change in depression from intake to discharge ($t(39) = 7.411, p < .000, d = 1.172$, large effect size). There was also a change in anxiety from intake ($t(39) = 5.095, p < .000, d = .806$), stress ($t(39) = 6.079, p < .000, d = .0961$, large effect size), and pessimism ($t(39) = 4.654, p < .000, d = .736$, large effect size). In other words, participants experienced decreases in all of the vulnerability measures.

Figure 3

Boxplots for Mean Vulnerabilities (Intake and Discharge)



Note: $N = 40$. Box plots indicating mean scores, 25% and 75% percentiles for depression, anxiety, stress, and pessimism at intake and discharge. $* = p < .05$, $** = p < .01$. The error bars indicate 95% confidence intervals.

Figure 4*Boxplots for Mean Strengths (Intake and Discharge)*

Note: $N = 40$. Box plots indicating mean scores, 25% and 75% percentiles for optimism, hope, spirituality, social support, and grit at intake and discharge. * = $p < .05$, ** = $p < .01$. The error bars indicate 95% confidence intervals.

Figure 4 shows that participants' levels of optimism, hope, spirituality, social support, and grit all increased from intake to discharge. We adjusted for Bonferroni correction by dividing the alpha level of .05 by the five t-tests performed. This calculation meant that the significance level alpha was changed from $p < .05$ to $p < .01$ for all

strengths. Inferential statistics (related t-tests) confirmed that the differences in levels of hope, social support, and grit statistically significant. Changes in levels of optimism and spirituality were not statistically significant.

Participants saw a change in levels of hope from intake to discharge ($t(39) = -2.973, p < 0.01, d = -.470$) in social support ($t(39) = -4.406, p < 0.01, d = -.697$), and in grit ($t(39) = -2.73, p < 0.01, d = -.432$). There was a change in levels of optimism from intake to discharge ($t(39) = -1.794, p > 0.05, d = .284$) and spirituality ($t(39) = -2.366, p > 0.05, d = -.607$), these results were not significant.

Table 1

Means and Standard Deviations for Treatment Outcome Measures, Pain Self-efficacy, Vulnerabilities, and Strengths (Intake and Discharge)

Variable	Intake		Discharge		95% CI	<i>t</i>	<i>p</i>	Cohen's <i>d</i>
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>LL, UL</i>			
Treatment Outcome Measures								
Pain catastrophising	24.725	14.301	12.752	9.506	16.165, 5.827	5.827	<.000	.921
Pain intensity	22.475	5.444	16.450	4.961	4.354, 7.696	7.292	<.000	1.153
Interference	46.975	11.506	24.650	11.725	17.785, 26.865	9.945	<.000	1.573
Pain Self-efficacy	24.525	11.449	39.525	11.589	-18.746, -11.251	-8.094	<.000	1.280
Vulnerabilities								
Depression	8.800	5.336	2.300	1.977	4.726, 8274	7.411	<.000	1.172
Anxiety	6.325	4.072	3.150	1.902	1.915, 4.435	5.095	<.000	.806
Stress	10.425	5.879	5.175	3.594	3.503, 6.997	6.079	<.000	.096
Pessimism	9.125	3.014	7.175	3.003	1.102, 2.798	4.654	<.000	.736
Strengths								
Optimism	9.075	2.474	9.700	2.103	-1.330, .070	-1.794	.081	.284
Hope	26.665	5.056	29.050	6.627	-3.991, -.759	-2.973	.005	-.470
Spirituality	37.850	6.724	39.880	7.852	-3.617, -.283	-2.366	.023	-.607
Social support	27.975	7.427	31.350	6.908	-4.924, 4.627	-4.406	<.000	-.697
Grit	26.325	4.627	28.075	4.958	-3.045, -.455	-2.73	.009	-.432

Note. Mean changes have not been standardised. CI = confidence interval; LL = lower limit, UL= upper limit.

Discussion

Pain management programmes want to see changes in levels of treatment outcome measures - pain catastrophising, pain intensity, interference, and pain self-efficacy. Results from participants who took part in the ReCharge Programme clearly demonstrate that clients saw statistically significant changes in all of these measures from intake to discharge (Table 1). Our analyses found that the highest level of change was for interference, followed by pain self-efficacy, pain catastrophising, and pain intensity. Interference refers to how often a person's pain interferes with their daily life, while pain self-efficacy refers to how confident a person is that they can manage their daily life despite the pain.

We were expecting to find that pain self-efficacy was the variable with the greatest level of change given the current research, which highlights the association between pain self-efficacy, all the other treatment outcome measures, all the vulnerabilities, and all the strengths. The fact that interference saw a greater level of change may be due to the wording of the scales. The scale for interference asks, "During the past week, how much has pain interfered with the following?" (Jensen & McFarland, 1993). The pain self-efficacy scale is worded, "Remember, this questionnaire is not asking whether or not you have been doing these things, but rather how confident you are that you can do them at present despite the pain" (Nicholas, 2007). This may appear to be merely semantics, but there is also a possibility that participants were not letting the pain interfere as much as they normally would 'during the past week' while taking part in the ReCharge Programme.

The ReCharge Programme is a three-week inpatient programme where participants are given a weekly timetable from Monday to Friday, beginning at 7.00am and finishing at 5.00pm. The expectation that participants could and would complete these daily tasks may have motivated people to push themselves to do things they would not have attempted otherwise. It is interesting though that this increase in actual ability to complete tasks did not lead to an equal increase in people's confidence in their ability to

complete tasks. People living with chronic pain often face a multitude of other hurdles in daily life such as a low income, lack of support, social isolation, and limited access to facilities such as gyms and hydrotherapy pools. While in the ReCharge Programme these hurdles disappear, so it may be that people are less confident that they can continue with these tasks once they go back home.

Participants also saw statistically significant changes in depression, stress, anxiety, and pessimism, respectively. The ReCharge Programme includes interventions aimed at reducing levels of these vulnerabilities, therefore, we would expect to see these changes. The scores from the scales completed at discharge may be positively skewed, in that on their final day of the programme participants could be buoyed up by the previous three weeks achievements and feeling more hopeful about the future. It would be interesting to be able to determine if these levels held over the 12-week follow-up period, however, we did not have the number of participants necessary to make that analysis.

Among the strengths, there were statistically significant differences in social support, hope, and grit, not in optimism or spirituality. Unlike the treatment outcome measures and vulnerabilities, most of these strengths are not explicitly targeted by the ReCharge Programme. The fact that significant changes still occurred would suggest that introducing interventions aimed at increasing levels of strengths could help to improve treatment outcome measures and levels of vulnerabilities. Based on the literature, we were expecting to see some level of change in optimism, especially given the changes in levels of all treatment outcome measures. Optimism is associated with all treatment outcome measures, vulnerabilities, and strengths. Therefore, we would expect that changes in levels of any other variable could potentially lead to a change in levels of optimism.

Hope is the one strength that is currently included in the ReCharge Programme, as a strong focus over the three weeks is on defining and achieving goals. Hope is

defined of as pathway (being able to see a path towards achieving ones' goals) and agency (one's ability to navigate that pathway) (Snyder et al., 1991). Over the course of the ReCharge Programme participants not only learn how to frame their goals, but they are also being positively reinforced for achieving their goals within the programme. The skills learnt in the programme also include flexibility, the ability to recognise if a plan is not working as intended and devise a new, more achievable, course of action.

Overall, it appears that the ReCharge Programme was successful in significantly reducing levels of pain catastrophising, pain intensity, interference, depression, anxiety, stress, and pessimism for our 40 participants. It also significantly increased levels of pain self-efficacy, hope, social support, and grit. The increases in levels of strengths are currently occurring without targeted interventions, therefore, it is possible that working to increase levels of strengths could further contribute to the positive changes in all areas of a participants' chronic pain management.

Research Question 2

Our second research question was: Were there any associations between the treatment outcome measures, vulnerabilities and strengths?

Results

We calculated Pearson's correlations in order to determine whether the associations between treatment outcome measures, vulnerabilities, and strengths were significant, (see Table 2 for descriptive statistics). The only variables that were not significantly correlated with treatment outcome measures were anxiety and social support. All correlations met the assumptions of normality, as assessed by the Shapiro-Wilk's test ($p > .05$).

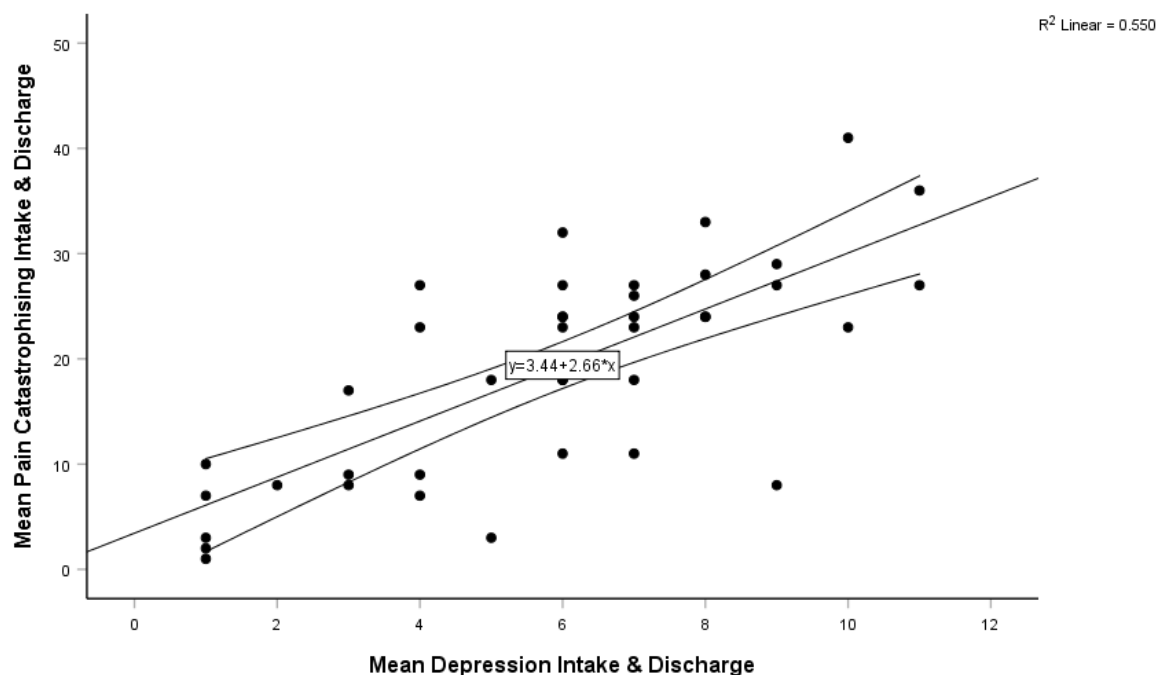
As participant's levels of depression, stress, and pessimism increased, their levels of pain catastrophising, pain intensity, and interference also increased. As participants' levels of optimism, hope, spirituality, and pain self-efficacy increased, their levels of pain

catastrophising and interference decreased. As levels of optimism increased, levels of pain intensity decreased.

As shown in Figure 5, there was a strong positive correlation between levels of pain catastrophising and depression, $r(38) = .742$, $p < .01$, $R^2 = .550$. Figure 6 shows there was a strong negative correlation between levels of pain catastrophising and hope, $r(38) = -.549$, $p < .01$, $R^2 = .309$. In other words, people with higher levels of depression had higher levels of pain catastrophising, those with higher levels of hope had lower levels of pain catastrophising.

Figure 5

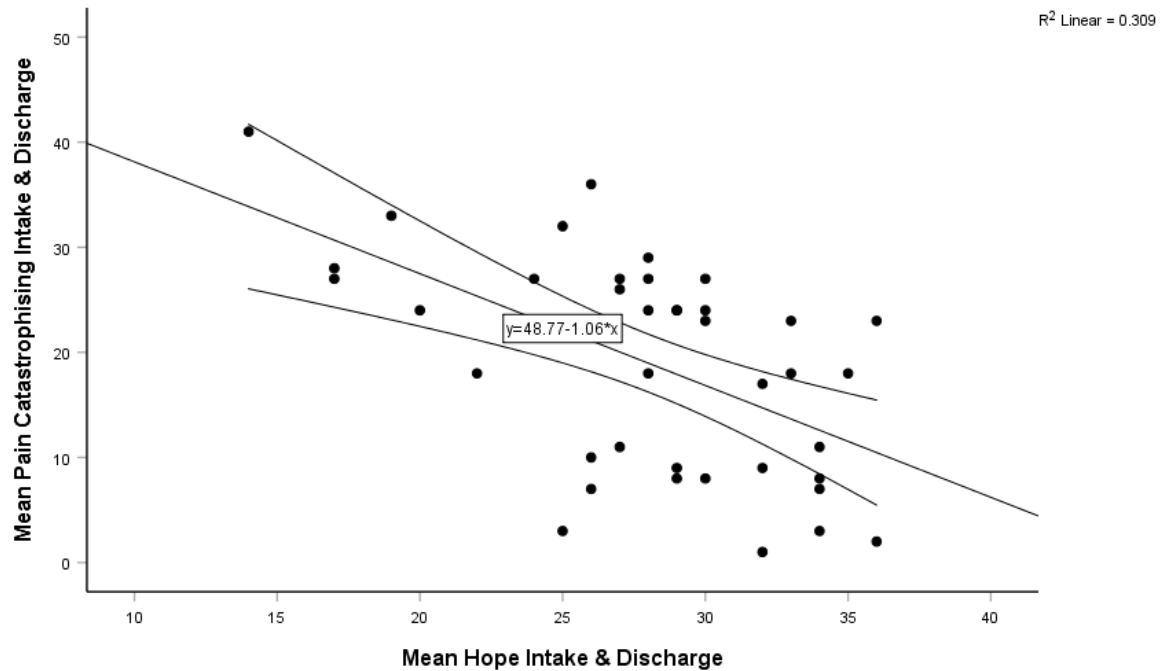
Scatterplot for Mean Pain Catastrophising and Mean Depression (Intake and Discharge)



Note: $N = 40$. Scatter plot for Pearson's correlations of mean pain catastrophising (intake and discharge) and mean depression (intake and discharge), including 95% confidence intervals.

Figure 6

Scatterplot for Mean Pain Catastrophising and Mean Hope (Intake and Discharge)



Note: $N = 40$. Scatter plot for Pearson's correlations of mean pain catastrophising (intake and discharge) and mean hope (intake and discharge), including 95% confidence intervals.

Table 2

Pearson's Correlations for Mean Levels of Treatment Outcome Measures, Pain Self-efficacy, Vulnerabilities, and Strengths (Intake and Discharge)

Variable	Pain	catastrophising Pain intensity	Interference	Pain self-efficacy	Depression	Anxiety	Stress	Pessimism	Optimism	Hope	Spirituality	Social Support
Treatment outcome measures												
Pain intensity	.457**											
Interference	.609**	.471**										
Pain self-efficacy	-.417**	-.170	-.452**									
Vulnerabilities												
Depression	.742**	.187	.508**	-.346*								
Anxiety	.243	.001	.172	-.257	.401**							
Stress	.583**	.237	.533**	-.417**	.707**	.611**						
Pessimism	.589**	.424**	.406**	-.348*	.517**	.304*	.412**					
Strengths												
Optimism	-.521**	-.325*	-.359*	-.344*	-.583*	-.273*	-.448**	-.686**				
Hope	-.549**	-.252	-.367**	-.606**	-.501**	-.370**	-.492**	-.581**	.535**			
Spirituality	-.487**	-.127	-.421**	-.459**	-.542**	-.340*	-.497**	-.608**	.673**	.724**		
Social support	-.150	.103	-.083	-.192	-.266*	.069	-.305*	-.291*	.526**	.272*	.536**	
Grit	-.440**	-.079	-.189	-.572**	-.410**	-.227	-.315*	-.220	.318*	.614**	.383**	.138

Note: This table shows the correlation of mean (intake and discharge) scores for all treatment outcome measures, vulnerabilities, and

strengths. Mean scores have not been standardised. ** Correlation is significant at the 0.01 level (2-tailed). * Correlation is significant at the 0.05 level (2-tailed).

We were also interested in analysing the relationships between overall totals of vulnerabilities, and strengths correlate with levels of pain catastrophising, pain intensity, and interference, and pain self-efficacy.

We calculated the total score for each scale measuring treatment outcome measures (pain catastrophising, pain intensity, interference), pain self-efficacy, vulnerabilities (depression, anxiety, stress, pessimism), and strengths (optimism, hope, spirituality, social support, grit) from each participants intake and discharge scales. We then calculated the mean total scores for each scale (see Table 3). All relationships reported are linear and have met the assumption of normal distribution (Shapiro-Wilk's test $p > .05$).

We then calculated correlations between levels of mean treatment outcome measures (including pain self-efficacy), vulnerabilities, and strengths (see Table 2 for descriptive statistics). As all of the treatment outcome measures, vulnerabilities, and strengths are significantly correlated we next transformed the scores to standardised z-scores as the scales were all measured differently. Finally, we created composite scores for mean treatment outcome measures (including pain self-efficacy), mean vulnerabilities, and mean strengths by adding the mean totals for each group together (Table 4).

Table 3

Mean Levels of Treatment Outcome Measures, Pain Self-efficacy, Vulnerabilities, and Strengths

Variable	M	95% CI LL, UL	SD	N
Treatment outcome measures				
Pain catastrophising	18.95	15.68, 22.22	10.215	40
Pain intensity	19.78	18.34, 21.21	4.481	40
Interference	36.00	33.06, 38.94	9.193	40
Pain self-efficacy	32.25	29.08, 35.42	9.907	40
Vulnerabilities				
Depression	5.83	4.94, 6.74	2.845	40
Anxiety	5.00	4.20, 5.80	2.512	40
Stress	8.03	6.73, 9.32	4.060	40
Pessimism	8.43	7.56, 9.29	2.697	40
Strengths				
Optimism	9.58	8.93, 10.22	2.024	40
Hope	28.03	26.32, 29.73	5.337	40
Spirituality	39.08	36.90, 41.25	6.814	40
Social support	29.85	27.69, 32.01	6.739	40
Grit	27.48	26.10, 28.85	4.291	40

Note. Means have not been standardised. CI = confidence interval; LL = lower limit, UL = upper limit.

Table 4

Pearson's Correlations for Mean Composite Treatment Outcome Measures, Pain Self-efficacy, Composite Vulnerabilities, and Composite Strengths

	Composite Treatment Outcome Measures	Pain Self-efficacy	Composite Vulnerabilities
Pain Self-efficacy	-.456**		
Composite Vulnerabilities	.655**	-.440**	
Composite Strengths	-.461**	.560**	-.632**

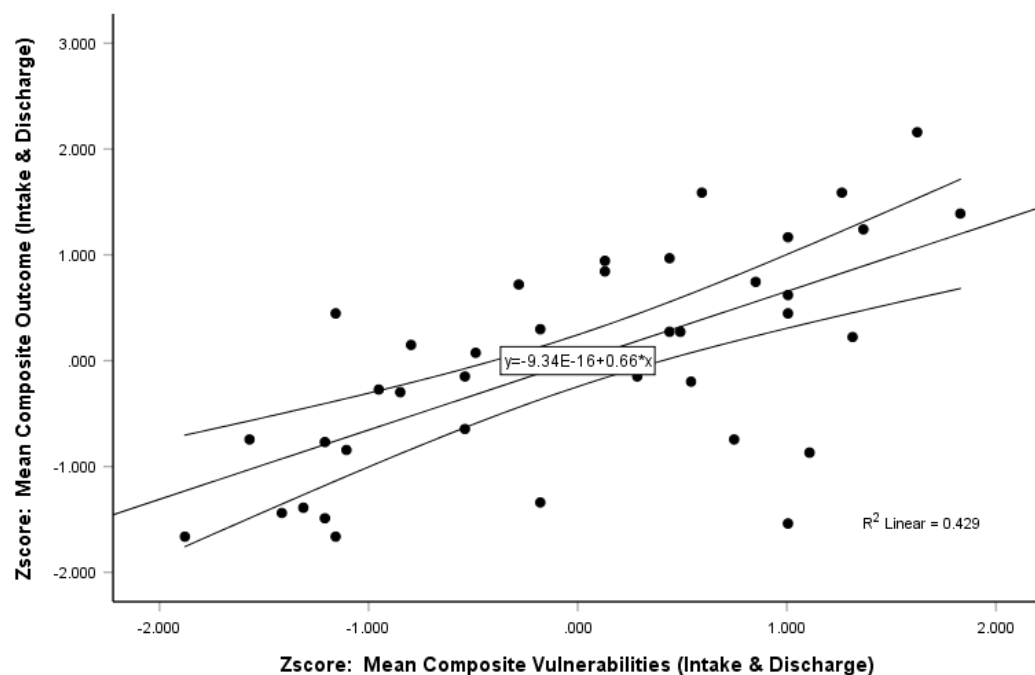
Note: This table shows the Pearson's correlations for the mean composite z-scores for treatment outcome measures, pain self-efficacy, vulnerabilities, and strengths. **

Correlation is significant at the 0.01 level (2-tailed).

There was a statistically significant positive correlation between mean composite treatment outcome measures and mean composite vulnerabilities, $r(38) = .655$, $p < .01$, $R^2 = .429$. Participants with higher mean total vulnerabilities had higher levels of mean treatment outcome measures (Figure 7). The positive nature of this correlation means that as participants' levels of vulnerabilities increase their levels of treatment outcome measures increased.

Figure 7

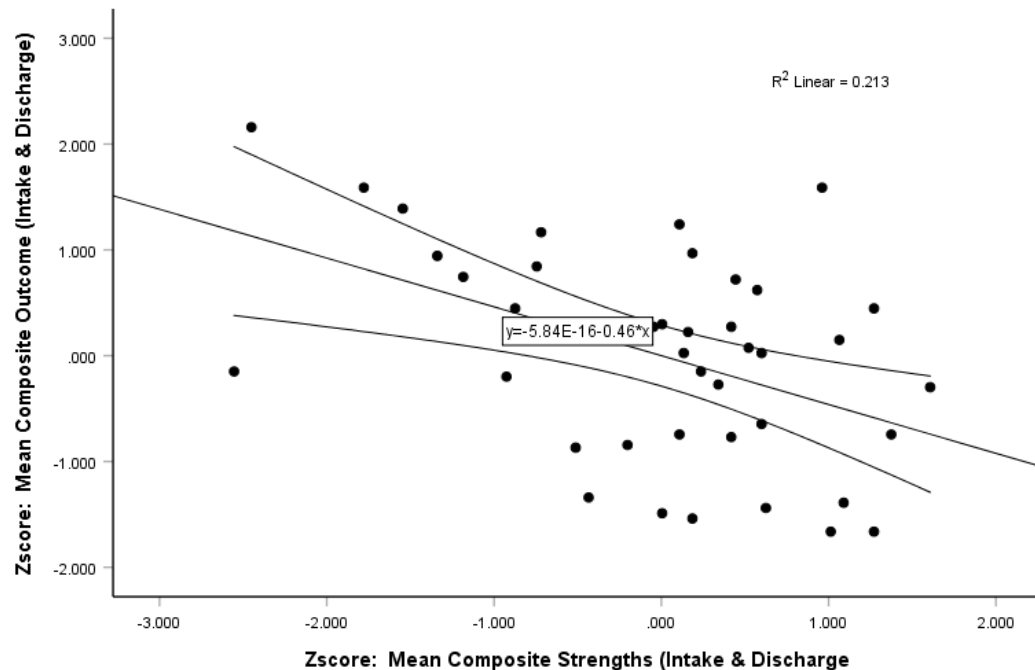
Scatterplot for Composite Treatment Outcome and Composite Vulnerabilities (Intake and Discharge)



Note: $N = 40$. Scatter plot for Pearson's correlations of mean composite vulnerabilities z-scores (intake and discharge) and mean composite treatment outcome measures z-scores (intake and discharge), including 95% confidence intervals.

Figure 8

Scatterplot for Composite Treatment Outcomes and Composite Strengths (Intake and Discharge)

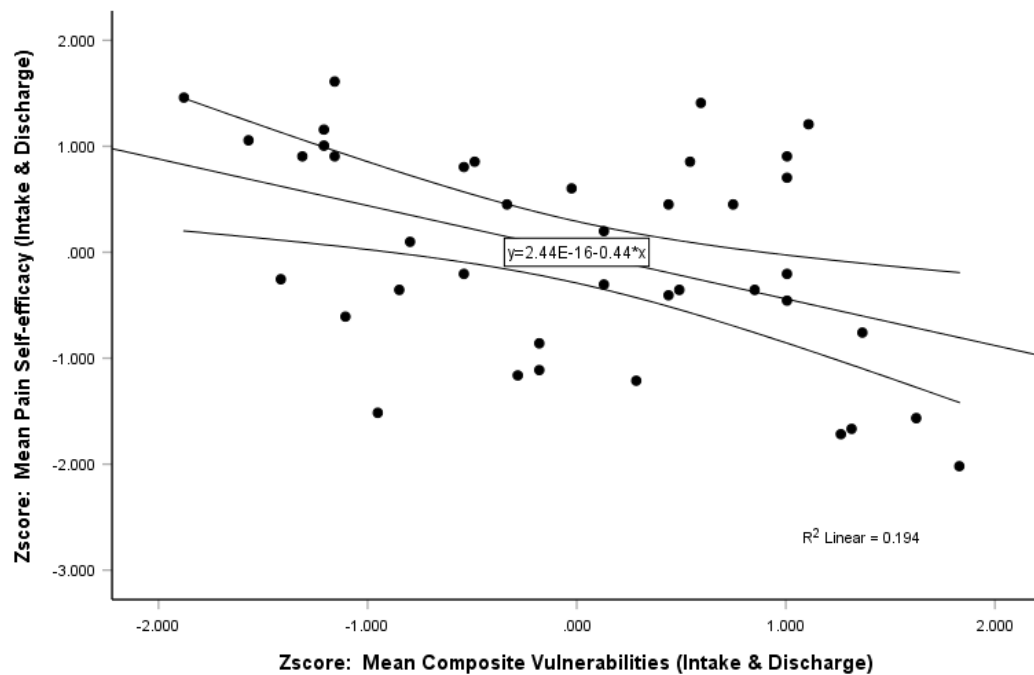


Note: $N = 40$. Scatter plot for Pearson's correlations of mean composite strengths z-scores (intake and discharge) and mean composite treatment outcome measures z-scores (intake and discharge), including 95% confidence intervals.

There was a statistically significant negative correlation between mean composite treatment outcome measures and mean composite strengths, $r(38) = -.614$, $p < .01$, $R^2 = .213$. Participants with higher levels of mean composite strengths had lower levels of mean composite treatment outcome measures (Figure 8). This correlation is negative, meaning that as participants' levels of strengths increased, their levels of treatment outcome measures decreased.

Figure 9

Scatterplot for Pain Self-efficacy and Composite Vulnerabilities (Intake and Discharge)



Note: $N = 40$. Scatter plot for Pearson's correlations of mean self-efficacy z-scores (intake and discharge) and mean composite vulnerabilities z-scores (intake and discharge), including 95% confidence intervals.

There was a statistically significant negative correlation between mean pain self-efficacy and mean composite vulnerabilities, $r(38) = -.440$, $p < .01$, $R^2 = .194$. Participants with higher levels of mean pain self-efficacy had lower levels of mean composite vulnerabilities (Figure 9). This correlation is negative, meaning that as participants' levels of pain self-efficacy increased, their levels of treatment outcome measures decreased.

Figure 10

Scatterplot for Pain Self-efficacy and Composite Strengths (Intake and Discharge)



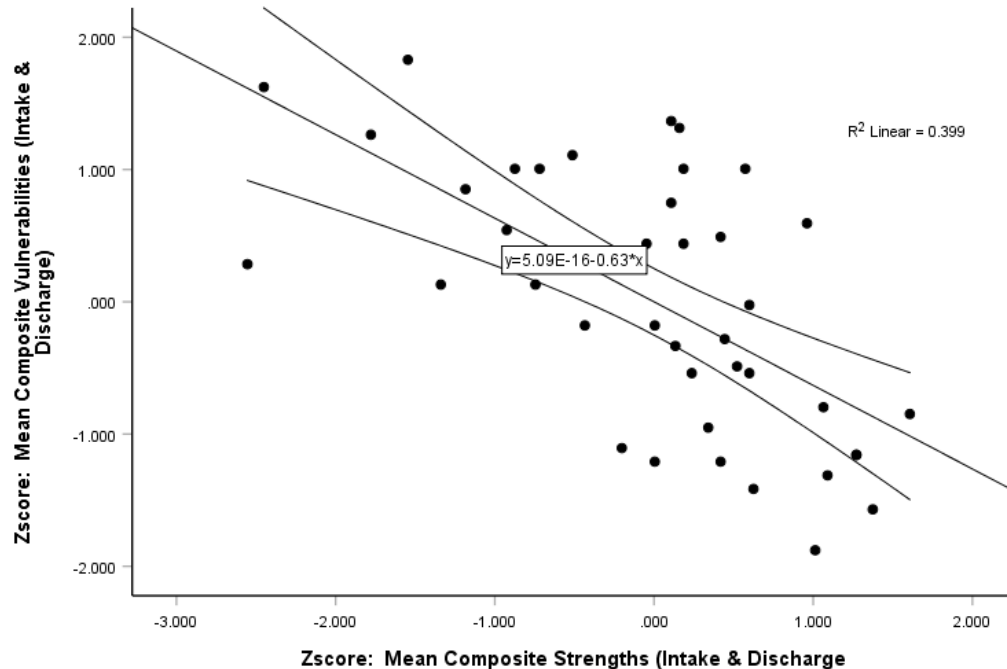
Note: $N = 40$. Scatter plot for Pearson's correlations of mean pain self-efficacy z-scores (intake and discharge) and mean composite strengths z-scores (intake and discharge), including 95% confidence intervals.

There was a statistically significant positive correlation between mean pain self-efficacy and mean composite strengths, $r(38) = .560$, $p < .01$, $R^2 = .314$. Participants with higher levels of mean pain self-efficacy had higher levels of mean composite strengths (Figure 10). This correlation is positive, meaning that as participants' levels of pain self-efficacy increased, so did their levels of composite strengths.

There was a statistically significant negative correlation between mean total vulnerabilities and mean total signature strengths, $r(38) = -.632$, $p < .01$, $R^2 = .399$. Participants who had higher levels of mean total vulnerabilities had lower mean levels of signature strengths (Figure 11).

Figure 11

Scatterplot for Composite Vulnerabilities and Composite Strengths (Intake and Discharge)



Note: $N = 40$. Scatter plot for Pearson's correlations of mean composite vulnerabilities z-scores (intake and discharge) and mean composite strengths z-scores (intake and discharge), including 95% confidence intervals.

Discussion

Overall, having lower levels of depression, stress, and pessimism, and higher levels of optimism, hope, spirituality, and grit were correlated with improvements in treatment outcome measures during the ReCharge Programme.

Participants with higher levels of pain catastrophising had higher levels of depression, stress, and pessimism, with depression accounting for 55% of the variance in pain catastrophising (Figure 5). Rumination and feelings of helplessness are key components in depression; therefore, we would expect to see a relationship between changes in pain catastrophising and depression. This high level of depression is in line with a review by Bair et al. (2003) who found that there were higher rates of depression in

chronic pain populations, and higher rates of chronic pain in populations with depression, than in the general population. In our study, higher levels of depression were also significantly associated with lower levels of optimism, hope, spirituality, social support, and grit.

Interestingly, we did not find a correlation between pain catastrophising and anxiety. As anxiety is often comorbid with depression, we were expecting to see that mean anxiety levels were similar to mean levels of depression. Participants who had higher levels of pain intensity had higher levels of pessimism, while people who had higher levels of interference also had higher levels of depression, stress, and pessimism.

Participants with higher mean levels of optimism, hope, spirituality, grit, and pain self-efficacy had lower mean levels of pain catastrophising, with hope accounting for 30.9% of the variance in pain catastrophising (Figure 6). We did not find any correlations between pain intensity and hope, spirituality, social support, grit, and pain self-efficacy. We did find that participants with lower levels of pain intensity had higher levels of optimism, which we were expecting to see. We did not find any correlations between pain interference and social support or grit.

Research Question 3

Our third research question was : Did the vulnerability and strength measures have any predictive power on the treatment outcome measures?

Results

In order to answer this question, we attempted to calculate several hierarchical multiple regressions. We used the change (from intake to discharge) of the composite scores of the first outcome measures (pain catastrophising, pain intensity, interference), as well as the second outcome measure (pain self-efficacy), as dependent variables and the composite score of the vulnerability measures (anxiety, depression, stress, pessimism) and the composite score of the strength measures (optimism, hope, spirituality, social support, grit) as predictors.

From the outset we were aware that our small sample size (N=40) would give us very little statistical power for generating significant regression models. Nevertheless, one model, entering the composite score of the vulnerability measures as the predictor into the regression with one of the outcome (dependent) measure (composite score of pain catastrophising, pain intensity, and interference) returned a significant effect (see Table 5). The vulnerability measures (composite score) were accounting for almost 25% (see R Squares) of the changes in the dependent variable from intake to discharge ($R^2 = .245$, $F(1, 39) = 12.354$ $p < 0.01$). All other models were not significant. This means that the changes (decreased levels) in depression, anxiety, stress, and pessimism were so strong that they significantly and positively influenced the treatment outcomes, even in a sample of only 40 participants.

Table 5

Results for Multiple Regression Model 1

Model	R	R Square	Adjusted R Square	Std Error of the Estimate	R Square Change	F Change	df1	df2
1	.495 ^a	.245	.225	7.14741	.245	12.354	1	

Note: This table presents the results of a hierarchical multiple regression for the

composite score of pain catastrophising, pain intensity, and interference. a. Predictor:

(Constant), Vulnerabilities Change Composite

Discussion

Despite working with very little statistical power, one model of the conducted multiple regressions was significant. The vulnerability measures (depression, anxiety, stress, and pessimism) seem to influence the outcome measures (pain catastrophising, pain intensity, and interference) to a very large extent and it is therefore recommended to continue addressing the vulnerabilities of participants during the ReCharge Programme. In order to assess appropriately the effect of the vulnerability and strength variables as predictors on the changes of pain self-efficacy via multiple regression we would need to recruit a larger sample of participants. Likewise, the effects of the strength predictor variables on the dependent composite score of pain catastrophising, pain intensity, and interference needs to be assessed in a larger sample.

Research Question 4

Our final research question was: Were there any long-term effects of the treatment outcome measures at follow-up?

Results

In order to answer this question, we followed the same procedure we used to answer our first research question. We first calculated the mean and variability scores for all variables at discharge and at 12-week follow-up (see Table 4 for descriptive statistics). We then created box plots depicting means (horizontal line within the boxes and 25% and 75% percentiles, lower and upper boundaries and with 95% confidence intervals (error bars) for treatment outcome measures (Figure 7), pain self-efficacy (Figure 8), vulnerabilities (Figure 9), and strengths (Figure 10).

Inferential statistics (paired samples t-tests) confirmed that the differences in levels of all treatment outcome measures, including pain self-efficacy, from discharge to follow-up were not statistically significant. Given the small sample size it is not surprising that we did not find any statistically significant changes. Although there were a number of outliers in the sample, they were assessed to be correct and valid values when compared

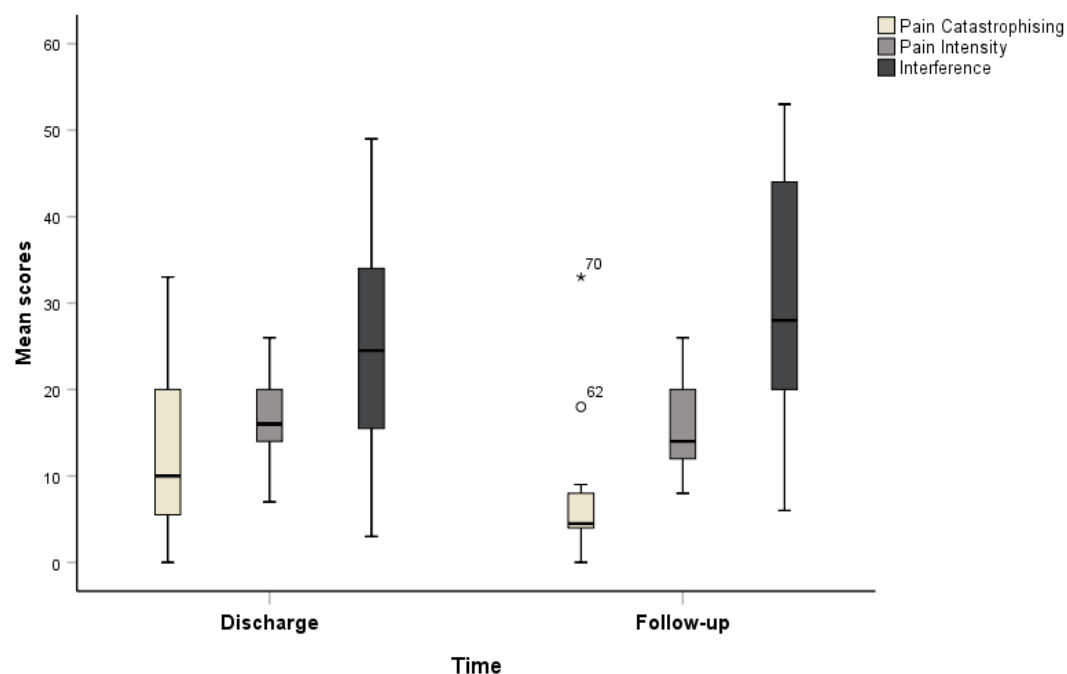
with values from the full participant pool ($N=14$) for intake and discharge and were left in the analyses.

As we can see in Figure 12, participants saw a decrease in pain catastrophising from discharge to follow-up ($t(13) = 2.005$, $p = .066$, $d = .890$). However, participants saw an increase in pain intensity ($t(13) = -.477$, $p = .641$, $d = 1.347$) and in interference ($t(13) = -1.781$, $p = .098$, $d = 1.501$).

In other words, participants' levels of pain catastrophising decreased, however, mean levels of interference increased, while pain intensity also increased slightly during the period between discharge and 12-week follow-up.

Figure 12

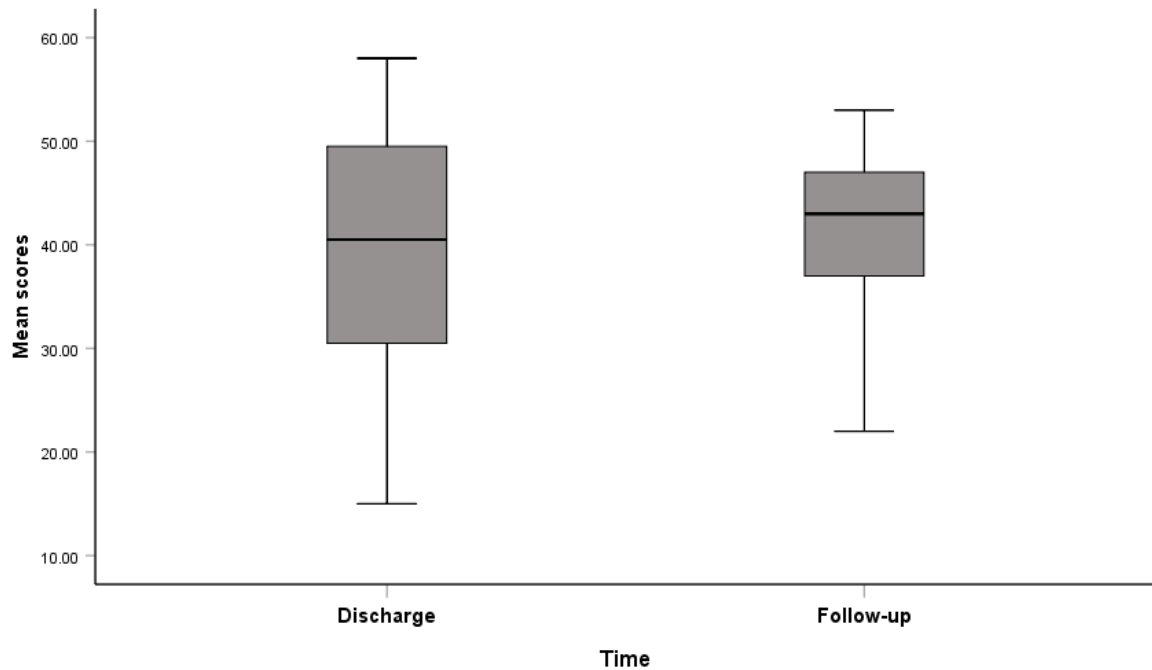
Boxplots for Mean Treatment Outcome Measures (Discharge and Follow-up)



Note: $N = 14$. Box plots indicating mean scores, 25% and 75% percentiles for pain catastrophising, pain intensity, and interference at discharge and 12-week follow-up. The error bars indicate 95% confidence intervals.

Figure 13

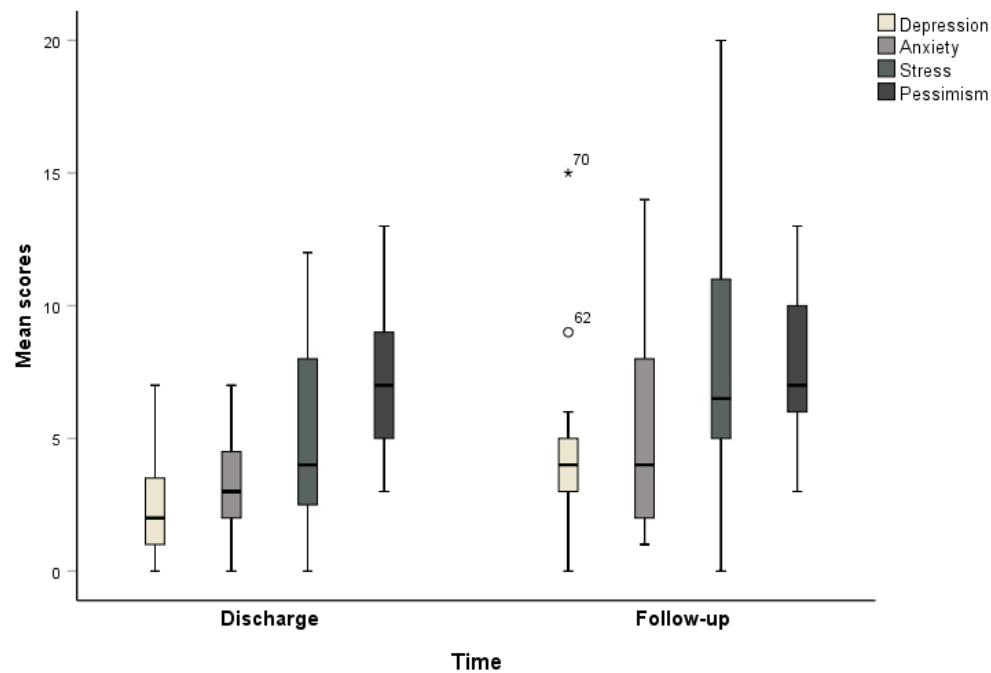
Boxplots for Mean Pain Self-efficacy (Discharge and Follow-up)



Note: $N = 14$. Box plots indicating mean scores, 25% and 75% percentiles for the outcome measure pain self-efficacy at discharge and 12-week follow-up. The error bars indicate 95% confidence intervals.

As we can see in Figure 13, participants saw a very slight decrease in pain self-efficacy from discharge to follow-up ($t(13) = .326$, $p = .749$, $d = -1.646$).

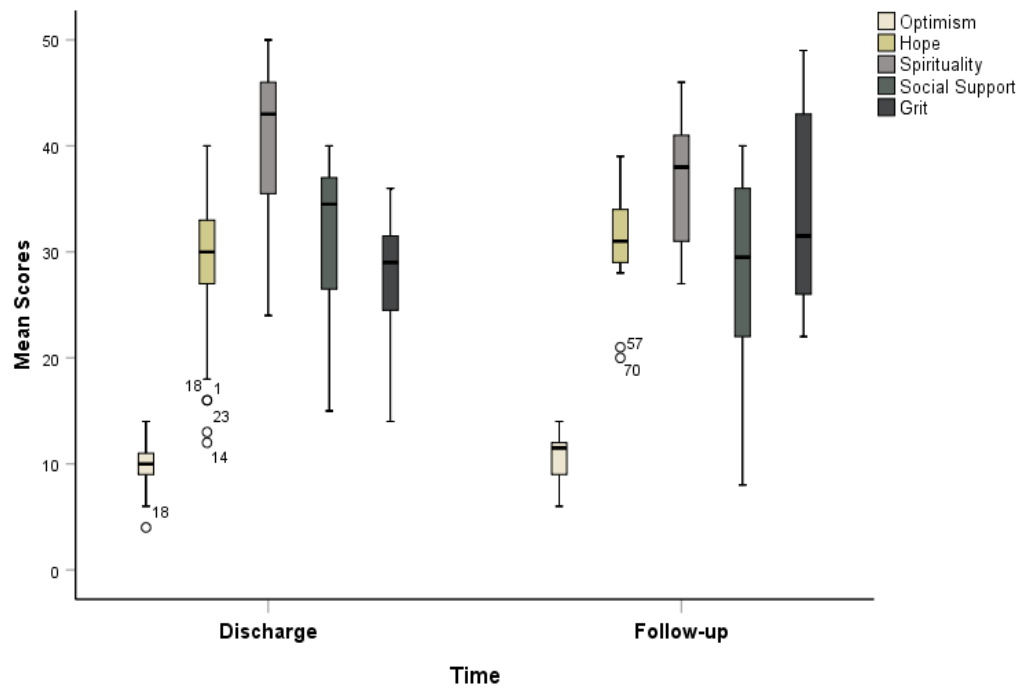
The mean score for levels of pain self-efficacy stayed relatively stable between discharge from the ReCharge Programme and follow up 12 weeks later.

Figure 14*Boxplots for Mean Vulnerabilities (Discharge and Follow-up)*

Note: $N = 14$. Box plots indicating mean scores, 25% and 75% percentiles for depression, anxiety, stress, and pessimism at discharge and 12-week follow-up. The error bars indicate 95% confidence intervals.

When we ran paired sample t-tests for the vulnerabilities we adjusted for Bonferroni correction by dividing the alpha level of .05 by the four t-tests performed. This calculation meant that the significance level alpha was changed from $p < .05$ to $p < .0125$ for all vulnerabilities.

As we can see in Figure 14, stress was the only vulnerability that showed a statistically significant difference from discharge to follow up, ($t(13) = -3.218$, $p = .007$, $d = .920$), however, this was an increase in levels of stress, not a decrease. Participants also saw increases in levels of depression ($t(13) = -2.047$, $p = .061$, $d = 1.060$), anxiety ($t(13) = -1.429$, $p = .177$, $d = 0.751$), and pessimism ($t(13) = -1.716$, $p = .110$, $d = 0.998$), none of which were significant.

Figure 15*Boxplots for Mean Strengths (Discharge and Follow-up)*

Note: $N = 14$. Box plots indicating mean scores, 25% and 75% percentiles for optimism, hope, spirituality, social support, and grit at discharge and 12-week follow-up. The error bars indicate 95% confidence intervals.

As we can see in Figure 15, levels of grit increased from discharge to follow up, ($t(13) = -2.321, p = .037, d = -.884$). Levels of optimism ($t(13) = -.530, p = .605, d = .554$) and hope ($t(13) = .358, p = .726, d = -.734$) stayed relatively stable, while levels of spirituality ($t(13) = 2.498, p = .027, d = -.778$) and social support ($t(13) = 1.939, p = .074, d = -.594$) decreased.

In other words, levels of grit increased from discharge to follow up, while levels of hope and optimism were largely maintained after discharge. Levels of social support and spirituality decreased between discharge and 12-week follow-up. None of these changes were statistically significant when assessed with paired samples t-tests.

Table 6

Means and Standard Deviations for Treatment Outcome Measures, Pain Self-efficacy, Vulnerabilities, and Strengths at Discharge and Follow-up

Variable	Discharge		Follow-up		95% CI	<i>t</i>	<i>p</i>	Cohen's <i>d</i>
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>LL, UL</i>			
Treatment Outcome Measures								
Pain catastrophising	12.429	11.022	7.214	8.728	-.403, 10.831	2.005	.066	.890
Pain intensity	15.571	4.910	16.357	5.528	-4.346, 2.775	-.477	.641	1.347
Interference	23.286	11.317	30.429	15.027	-15.808, 1.522	-1.781	.098	1.501
Pain Self-efficacy	41.714	11.418	41.214	9.673	-2.811, 3.811	.326	.749	-1.646
Vulnerabilities								
Depression	2.286	2.268	4.623	3.962	-4.844, .130	-2.047	.061	1.060
Anxiety	3.714	1.816	5.500	3.995	-4.486, .915	-1.429	.177	0.751
Stress	4.786	3.093	7.571	4.972	-4.656, -.916	-3.218	.007	.920
Pessimism	6.286	2.920	7.357	2.920	-2.420, .277	-1.716	.110	0.998
Strengths								
Optimism	10.357	1.823	10.643	2.499	-1.450, .879	-.530	.605	.554
Hope	31.143	5.260	30.643	5.429	-2.519, 3.519	.358	.726	-.734
Spirituality	42.071	6.878	39.629	5.744	.694, 9.591	2.498	.027	-.778
Social support	32.357	6.160	28.429	8.618	-.448, 8.305	1.939	.074	-.594
Grit	28.786	4.526	33.500	9.338	-9.102, -.326	-2.321	.037	-.884

Note. *N* = 14. Mean changes have not been standardised. CI = confidence interval; LL = lower limit, UL= upper limit.

Discussion

Ideally, skills learned, and gains made during a pain management programme would be maintained after the programme finishes. Participants who are able to generalise the things they learn in a programme to their everyday life are more likely to maintain those changes.

Although we did not have enough participants (N=14) to make meaningful analyses, the data we did receive was not promising. It is important to note that the participants who did return the follow-up scales may not be representative of the entire sample for this study, which in turn may not be representative of the entire population of New Zealanders living with chronic pain. Out of all the variables that we measured, only pain catastrophising and grit showed improvements in levels from discharge to follow-up. Levels of pain self-efficacy, hope, and optimism appeared to be maintained during this period, however, levels of the pain intensity and interference treatment outcome measures worsened. All of the vulnerabilities worsened, with increased levels of stress, depression, anxiety, and pessimism, respectively. In the strengths, levels of social support and spirituality also worsened.

Decreases in levels of pain catastrophising alongside increases in levels of depression is an interesting pairing as the two share some similar constructs. We would expect that improvements in one of these variables would also lead to improvements of the other. One possible explanation could be that the ReCharge Programme has shifted participants maladaptive thoughts and beliefs regarding their pain to a more adaptive level, which participants have continued to challenge after discharge from the programme. At the same time, participants may also have experienced a post-programme slump as the access to services and staff available during the programme disappear. It has also been shown that for many people who seek help for psychological distress, the mere fact that someone is watching what you do can lead to changes in the way you behave

(McCarney et al., 2007). Once that attention (or pressure) is no longer there, participants may have returned to pre-programme patterns of behaviours that were problematic.

It is also interesting that levels of pain intensity, interference, depression, stress, and anxiety all increased post-programme, as these are all variables specifically targeted by the ReCharge Programme. On the other hand, levels of grit improved, and levels of hope and optimism were maintained, despite not being part of the programme. This leads one to wonder, is it better to attempt to decrease levels of vulnerabilities, increase levels of strengths, or target both concurrently?

General Discussion

Chronic pain is a growing problem, and part of the solution is to figure out what things help or hinder chronic pain management. There has been much research into the different factors that affect chronic pain management, the relationships between vulnerabilities (depression, anxiety, stress, pessimism) and treatment outcome measures (pain catastrophising, pain intensity, interference pain self-efficacy, or strengths (optimism, hope, spirituality, social support, grit). There are also studies that look at the interactions between one or two vulnerabilities and one or two strengths and/or treatment outcome measures. We could not find any studies that look at all of these variables at the same time.

Our study was designed to investigate changes in levels of treatment outcome measures, vulnerabilities, and strengths during the three-week ReCharge Programme and whether those changes were maintained at follow-up. We also analysed what the associations or correlations were between all of these different chronic pain variables. Overall, we found that participants levels of treatment outcome measures (excluding pain self-efficacy) and vulnerabilities decreased during the ReCharge Programme, while levels of pain self-efficacy and strengths increased. However, it did not appear that many of these improvements were maintained, or better yet increased, after a 12-week follow-up period.

Learning that you are capable of much more than you believed you were can have a powerful effect on both maladaptive schema, such as those seen in pain catastrophising, and in a person's confidence in their ability to complete daily tasks, as seen in pain self-efficacy. One of the fascinating things about pain catastrophising is that it is all based on a person's beliefs about their pain, rather than the actual pain itself. As we talked about earlier, the fear of the intensity of the pain is much more debilitating than the actual level of pain intensity. Catastrophic thinking does not have a physical effect on the pain intensity, but it does have a psychological effect. Giving people the tools so that they can learn to recognise and counter such thinking could be a powerful mechanism of change where people are able to transition back into the workforce and re-engage with social and leisure activities.

We found that optimism was the only strength significantly correlated with pain intensity, despite findings in the literature that hope, and social support were also associated with decreased levels of pain intensity (Berg et al., 2008). One reason for this discrepancy could be that in the experiments looking at the causal relationships between hope and levels of pain intensity, the pain was induced in a laboratory setting, these papers were looking at acute rather than chronic pain. The amount of time a person has been experiencing pain for, and the knowledge that one will continue experiencing this pain, may account for these differences. Undergoing a cold pressor task, where your hand is submerged in icy water for a set period of time is a very different pain experience. This research into the causal relationship is promising, there are few studies that can show directional causation between optimism or hope and pain intensity (Hanssen et al., 2014; Snyder et al., 2005). Learning different coping strategies in the ReCharge Programme, while simultaneously putting those strategies in place, could in turn increase participants' levels of optimism. Changing expectations about what the future may hold, learning that you are capable of more than you previously thought possible, may in turn make you view the future in a more optimistic manner.

We found that there were statistically significant associations between lower levels of pain catastrophising and higher levels of optimism, hope, spirituality, and grit. Increased levels of hope could be explained by the ReCharge Programme's focus on setting and achieving goals, largely by making sure that the goals are realistic and that the efforts made to reach them are slow and steady rather than 'boom or bust'. People living with chronic pain still often have good and bad days. On good days it can be tempting to try and do lots of things, but not necessarily helpful. Learning to pace yourself, regardless of your pain level, is much more adaptive than 'booming' on good days and then 'busting' on bad ones as a result of overdoing things (McCracken & Samuel, 2007). It is also more adaptive than not doing anything at all as avoiding movement and tasks can lead to higher levels of disability and psychological distress (Costa et al., 2011). The ability to set and achieve goals is important in pain management, and goals are a core concept in hope theory (Coduti & Schoen, 2014). Attaining goals can contribute to increasing pain self-efficacy and decreasing pain catastrophising and interference.

Not being able to achieve your goals can lead to negative emotions, and while hope is more of a cognitive process, we know that negative emotions can influence our thoughts (Snyder et al., 2000). Hope is broken down into pathway (how do you get to your goal) and agency (do you have the capacity to follow the pathway) (Snyder, 2002). For many people with chronic pain there can be multiple barriers on those pathways. In addition to the actual chronic pain itself, a lack in material and social resources can also bar the way. Having the mental and psychological flexibility to come up with a new pathway in the face of barriers can be difficult, but this is a skill that people can learn and utilise (Larsen et al., 2015).

Although we only had a small sample, we saw statistically significant changes in nearly all variables from intake to discharge of the ReCharge Programme, whether they were targeted or not. Adding interventions aimed at increasing participants' levels of strengths could be an easy and cost-effective way to boost or supplement the changes

seen in treatment outcome measures. These interventions could then be used after discharge from the programme in an attempt to maintain, or improve on, changes made during the programme.

Limitations

There were a number of limitations within this research project. Firstly, the small sample size, which was largely due to the impact of COVID-19 lock down requirements during the course of this study. The measures that were used were all self-report measures, which always run the risk of implicit participant bias in their responses. In addition, there were a large number of measures participants needed to complete, and the measures were repeated at three different time points. The measures were given to participants in the same order at every time point, therefore, there may have been order effects. The Chronic Pain Wellbeing Survey was the final scale participants completed, which means that the way in which participants responded to these questions may have been influenced by the previous scales. Originally, we had wanted to include participants on a wait list as a control group, however, the ReCharge Programme did not have a wait list.

Future Research

This study highlights the fact that chronic pain management is made up of multiple variables, which are highly individual and subjective. Being able to determine a client's levels of vulnerabilities and strengths before they enter a pain management programme could lead to more targeted, and possibly more effective, interventions.

Future research is needed on the causal and mediating relationships between treatment outcome measures, vulnerabilities, and strengths. It would also be helpful to be able to determine which vulnerabilities and strengths have the best predictive effect on treatment outcome measures. Finally, and ideally, future research should involve a double blind randomised controlled study, which was beyond the scope of a master's thesis.

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Appendices

Appendix A. QE Health and Spa Approach

The ReCharge Programme

QE Health (<https://www.qehealth.co.nz/recharge>) in Rotorua, New Zealand, runs a unique 3-week in-client pain management and rehabilitation programme. There is a strong focus on increasing problem solving and goal setting skills, which can then be generalised in the clients' daily lives. QE Health have created a robust biopsychosocial model for an intensive pain management programme. They were interested in finding out which, if any, of the strengths being investigated in this study could be used to increase the efficacy of their programme for specific individuals. For example, are higher levels of optimism associated with lower levels of pain intensity? Are higher levels of hope associated with lower levels of pain interference? If such relationships are found, then QE Health could incorporate interventions in the ReCharge Programme to target factors such as hope or optimism.

Appendix B. University of Waikato Human Research Ethics Committee Approval

4 December 2019
Eryn Campbell
School of Psychology
FASS

By email: ejc24@students.waikato.ac.nz

Dear Eryn

HREC(Health)2019#34 : What is the relationship between changes in levels of positive and negative aspects of a person's life and changes in levels of pain related measures for chronic pain patients?

Thank you for submitting your amended research plan for HREC(Health)2019#34 for ethical approval.

We are now pleased to provide formal approval for your project where you will carry out two forms of data collection:

- (1) collection of electronic data from patients attending the ReCharge pain management programme at Queen Margaret Hospital,
- (2) collection of paper-based data via Active+

The project objectives are the same for each form of data collection: you will use the data to assess the relationship between pain levels of chronic pain patients, and other positive and negative aspects of these patients' lives.

Please contact the committee by email (humanethics@waikato.ac.nz) if you wish to make changes to your project as it unfolds, quoting your application number with your future correspondence. Any minor changes or additions to the approved research activities can be handled outside the monthly application cycle.

We wish you all the best with your research.

Regards,

Julie Barbour PhD
Chairperson

Appendix C. Information and Consent Form



Kia ora, and thank you for your interest in this research project.

My name is Eryn Campbell and, like you, I suffer from chronic pain and have completed the ReCharge Programme. I am now a master's student in the Clinical Psychology programme at the University of Waikato, Hamilton.

This project is intended to determine if there is a relationship between changes in positive aspects of people's lives and changes in their pain measurements while taking part in a pain management program.

You have been invited to take part in this research because of your lived experience with chronic pain. This project may lead to a better understanding of how people living with chronic pain can improve their overall wellbeing, and your contribution will help me to do that. By participating in this research project, you are consenting to give me access to the information collected by QE Health at admission, discharge, and 3-month follow-up.

This research is confidential, your identity will not be revealed at any time. Please contact either Robert on email Robert.isler@waikato.ac.nz or Eryn on email ejc24@waikato.students.ac.nz if you have any questions regarding this project.

If you take part in the study, you have the right to:

- Stop answering questions at any time while completing the survey.
- Withdraw from the study before analysis has commenced on the data, up to the 1st of August 2020.
- Ask any further questions about the study that occur to you during your participation.
- Be given access to a summary of findings from the study when it is concluded.

I agree to take part in this research project and understand that by agreeing I am giving consent for Eryn Campbell to use both the data provided to QE Health and the additional questionnaires required for the project.

Signed: _____

Date: _____

This research has been approved by the Human Research Ethics Committee (Health) of the University of the University of Waikato under HREC (Health) 2019#34. Any questions about the ethical conduct of this research may be addressed to the Secretary of the Committee, email humanethics@waikato.ac.nz, postal address, University of Waikato, Te Whare Wananga o Waikato, Private Bag 3105, Hamilton 3240.

Appendix D. The Pain Catastrophizing Scale

PCS (Sullivan, Bishop, & Pivik, 1995)

Everyone experiences painful situations at some point in their lives. Such experiences may include headaches, tooth pain or muscle pain. People are often exposed to situations that may cause pain such as illness, injury, dental procedures, or surgery.

We are interested in the types of thoughts and feelings that you have when you are in pain. Listed below are thirteen statements describing different thoughts and feelings that may be associated with pain. Using the scale, please indicate the degree to which you have thoughts and feelings **WHEN YOU ARE EXPERIENCING PAIN.**

		Not at all	To a slight	To a moderat	To a great	All the time
1.	I worry all the time about whether the pain will end.	0	1	2	3	4
2.	I feel I can't go on.	0	1	2	3	4
3.	It's terrible and I think it's never going to get any better.	0	1	2	3	4
4.	It's awful and I feel it overwhelms me.	0	1	2	3	4
5.	I feel I can't stand it anymore.	0	1	2	3	4
6.	I become afraid that the pain will get worse.	0	1	2	3	4
7.	I keep thinking of other painful events.	0	1	2	3	4
8.	I anxiously want the pain to go away.	0	1	2	3	4
9.	I can't seem to keep it out of my mind.	0	1	2	3	4
10.	I keep thinking about how much it hurts.	0	1	2	3	4
11.	I keep thinking about how badly I want the pain to stop.	0	1	2	3	4
12.	There's nothing I can do to reduce the intensity of the pain.	0	1	2	3	4

- | | | | | | | |
|-----|--|---|---|---|---|---|
| 13. | I wonder whether something serious may | 0 | 1 | 2 | 3 | 4 |
| | happen. | | | | | |

Appendix E. Brief Pain Inventory for Chronic Non-malignant Pain

(Tan, Jensen., Thornby & Shanti, 2004)

Rate your pain by selecting the one number that best describes the following (0 = No pain, and 10 = Pain as bad as you can imagine).

- | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|----|
| 1. Your pain at its worst in the last week? | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 2. Your pain at its least in the last week? | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 3. Your pain on average? | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 4. How much pain do you have right now? | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |

During the past week, how much has pain interfered with the following? (0 = Does not interfere and 4 = Interferes completely).

- | | | | | | |
|--|---|---|---|---|---|
| 1. Your general activity? | 0 | 1 | 2 | 3 | 4 |
| 2. Your mood? | 0 | 1 | 2 | 3 | 4 |
| 3. Your walking ability? | 0 | 1 | 2 | 3 | 4 |
| 4. Your normal work (both outside the home and housework)? | 0 | 1 | 2 | 3 | 4 |
| 5. Your relations with other people? | 0 | 1 | 2 | 3 | 4 |
| 6. Your sleep? | 0 | 1 | 2 | 3 | 4 |
| 7. Your enjoyment of life? | 0 | 1 | 2 | 3 | 4 |

Appendix F. Pain Self Efficacy Questionnaire

PSEQ (Nicholas, 2007)

Please rate how **confident** you are that you can do the following things at present, **despite the pain**. To indicate your answer, select **one** of the numbers on the scale under each item, where 0 = not at all confident and 6 = completely confident.

Remember, this questionnaire is **not** asking whether or not you have been doing these things, but rather **how confident you are that you can do them AT PRESENT despite the pain**.

1	I can enjoy things, despite the pain	0	1	2	3	4	5	6
2	I can do most of the household chores (e.g., tidying up, washing dishes etc.), despite the pain	0	1	2	3	4	5	6
3	I can socialise with my friends or family members as often as I used to, despite the pain.	0	1	2	3	4	5	6
4	I can cope with my pain in most situations.	0	1	2	3	4	5	6
5	I can do some form of work, despite the pain ("work" includes housework, paid, and unpaid work).	0	1	2	3	4	5	6
6	I can still do many of the things I enjoy doing, such as hobbies or leisure activities.	0	1	2	3	4	5	6
7	I can cope with my pain without medication.	0	1	2	3	4	5	6
8	I can still accomplish most of my goals in life, despite the pain.	0	1	2	3	4	5	6
9	I can live a normal lifestyle, despite the pain.	0	1	2	3	4	5	6
10	I can gradually become more active, despite the pain.	0	1	2	3	4	5	6

Appendix G. Depression Anxiety & Stress Scales

DASS-21 (Henry & Crawford, 2005)

Please read each statement and select a number 0, 1, 2 or 3 which indicates how much the statement applied to you **OVER THE PAST WEEK**. There are no right or wrong answers. Do not spend too much time on any statement.

The rating scale is as follows:

- 0. Did not apply to me at all
- 1. Applied to me to some degree, or some of the time
- 2. Applied to me a considerable degree or a good part of time
- 3. Applied to me very much or most of the time

1.	I found it hard to wind down.	0	1	2	3
2.	I was aware of dryness of my mouth	0	1	2	3
3.	I couldn't seem to experience any positive feelings at all	0	1	2	3
4.	I experienced breathing difficulty (e.g., excessively rapid breathing, breathlessness in the absence of physical exertion)	0	1	2	3
5.	I found it difficult to work up the initiative to do things	0	1	2	3
6.	I tended to over-react to situations	0	1	2	3
7.	I experienced trembling (e.g., in the hands)	0	1	2	3
8.	I felt that I was using a lot of nervous energy	0	1	2	3
9.	I was worried about situations in which I might panic and make a fool of myself	0	1	2	3
10.	I felt that I had nothing to look forward to	0	1	2	3
11.	I found myself getting agitated	0	1	2	3
12.	I found it difficult to relax	0	1	2	3
13.	I felt downhearted and blue	0	1	2	3
14.	I was intolerant of anything that kept me from getting on with what I was doing	0	1	2	3

15.	I felt I was close to panic	0	1	2	3
16.	I was unable to become enthusiastic about anything	0	1	2	3
17.	I felt I wasn't worth much as a person	0	1	2	3
18.	I felt that I was rather touchy	0	1	2	3
19.	I was aware of the action of my heart in the absence of physical exertion (e.g., sense of heart rate increase, heart missing a beat)	0	1	2	3
20.	I felt scared without any good reason	0	1	2	3
21.	I felt that life was meaningless	0	1	2	3

Appendix H. Life Orientation Test Revised

LOT-R (Scheier, Carver, & Bridges, 1994)

Please be as honest and accurate as you can throughout. Try not to let your response to one statement influence your responses to other statements. There are no "correct" or "incorrect" answers. Answer according to your own feelings, rather than how you think "most people" would answer.

1 = I agree a lot

2 = I agree a little

3 = I neither agree nor disagree

4 = I disagree a little

5 = I disagree a lot

1. In uncertain times, I usually expect the best.	1	2	3	4	5
2. It's easy for me to relax.	1	2	3	4	5
3. If something can go wrong for me, it will.	1	2	3	4	5
4. I'm always optimistic about my future.	1	2	3	4	5
5. I enjoy my friends a lot.	1	2	3	4	5
6. It's important for me to keep busy.	1	2	3	4	5
7. I hardly ever expect things to go my way.	1	2	3	4	5
8. I don't get upset too easily.	1	2	3	4	5
9. I rarely count on good things happening to me.	1	2	3	4	5
10. Overall, I expect more good things to happen to me than bad.	1	2	3	4	5

Appendix I. The Adult Trait Hope Scale
(Snyder et al., 1991)

Directions: Read each item carefully. Using the scale shown below, please select the number that best describes YOU **TODAY**.

- 1. = Definitely False
- 2. = Mostly False
- 3. = Somewhat False
- 4. = Slightly False
- 5. = Slightly True
- 6. = Somewhat True
- 7. = Mostly True
- 8. = Definitely True

1. I can think of many ways to get out of a jam.	1	2	3	4	5	6	7	8
2. I energetically pursue my goals.	1	2	3	4	5	6	7	8
3. I feel tired most of the time.	1	2	3	4	5	6	7	8
4. There are lots of ways around any problem.	1	2	3	4	5	6	7	8
5. I am easily downed in an argument.	1	2	3	4	5	6	7	8
6. I can think of many ways to get the things in life that are important to me.	1	2	3	4	5	6	7	8
7. I worry about my health.	1	2	3	4	5	6	7	8
8. Even when others get discouraged, I know I can find a way to solve the problem.	1	2	3	4	5	6	7	8
9. My past experiences have prepared me well for my future.	1	2	3	4	5	6	7	8
10. I've been pretty successful in life.	1	2	3	4	5	6	7	8
11. I usually find myself worrying about something.	1	2	3	4	5	6	7	8

12. I meet the goals that I set for myself.	1	2	3	4	5	6	7	8
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Appendix J. Spirituality Scale

(Delaney, 2005)

Please indicate your level of agreement to the following statements by selecting the appropriated number that corresponds with the scale below.

1. Strongly disagree

2. Disagree

3. Mostly disagree

4. Mostly agree

5. Agree

6. Strongly agree

1. I find meaning in my life experiences.	1	2	3	4	5	6
2. I meditate to gain access to my inner spirit.	1	2	3	4	5	6
3. I believe there is a connection between all things that I cannot see but can sense.	1	2	3	4	5	6
4. I believe in a Higher Power / Universal Intelligence.	1	2	3	4	5	6
5. I believe that all living creatures deserve respect.	1	2	3	4	5	6
6. I value maintaining and nurturing my relationship with others.	1	2	3	4	5	6
7. I use silence to get in touch with myself.	1	2	3	4	5	6
8. My spirituality gives me inner strength.	1	2	3	4	5	6
9. I am able to receive love from others.	1	2	3	4	5	6
10. At times, I feel at one with the universe.	1	2	3	4	5	6

Appendix K. Duke-UNC Functional Social Support Questionnaire

FSSQ (Broadhead, Gehlbach, De Gruy, & Kaplan, 1988)

Here is a list of some things that other people do for us or give us that may be helpful or supportive. Please read each statement carefully and select the answer that is closest to your situation.

5 = As much as I would like

4 = Almost as much as I would like

3 = Some, but would like more

2 = Less than I would like

1 = Much less than I would like

1. I have people who care what happens to me.	5	4	3	2	1
2. I get love and affection	5	4	3	2	1
3. I get chances to talk to someone about problems at work or with my housework.	5	4	3	2	1
4. I get a chance to talk to someone I trust about my personal or family problems.	5	4	3	2	1
5. I get chances to talk about money matters.	5	4	3	2	1
6. I get invitations to go out and do things with other people.	5	4	3	2	1
7. I get useful advice about important things in life.	5	4	3	2	1
8. I get help when I am sick in bed.	5	4	3	2	1

Appendix L. Short Grit Scale
(Duckworth & Quinn, 2009)

Here are a number of statements that may or may not apply to you. For the most accurate score, when responding, think of how you compare to most people – not just the people you know well, but most people in the world. There are no right, or wrong answers so just answer honestly. Select the most appropriate number from the list below for each question.

1 = Very much like me

2 = Mostly like me

3 = Somewhat like me

4 = Not much like me

5 = Not like me at all

1. New ideas and projects sometimes distract me from previous ones	1	2	3	4	5
2. Setbacks don't discourage me	1	2	3	4	5
3. I have been obsessed with a certain idea or project for a short time but later lost interest	1	2	3	4	5
4. I am a hard worker	1	2	3	4	5
5. I often set a goal, but later choose to pursue a different one	1	2	3	4	5
6. I have difficulty maintaining my focus on projects that take more than a few months to complete	1	2	3	4	5
7. I finish whatever I begin	1	2	3	4	5
8. I am diligent	1	2	3	4	5

Appendix M. Chronic Pain Wellbeing Scale

Please read each statement and choose the response that best describes you right now. Be honest - there are no right or wrong answers, and do not think too long before choosing.

	Not like me at all	Not much like me	Somewhat like me	Mostly like me	Very much like me
1. New ideas and projects sometimes distract me from previous ones.	1	2	3	4	5
2. Setbacks don't discourage me	1	2	3	4	5
3. I have been obsessed with a certain idea or project for a short time but later lost interest.	1	2	3	4	5
4. I am a hard worker	1	2	3	4	5
5. I often set a goal but later chose to pursue a different one	1	2	3	4	5
6. I have difficulty maintaining my focus on projects that take more than a few months to complete	1	2	3	4	5
7. I finish whatever I begin	1	2	3	4	5
8. I am diligent	1	2	3	4	5
9. I have people who care what happens to me	1	2	3	4	5

10. I get love and affection	1	2	3	4	5
11. I get chances to talk to someone about problems at work or with my housework	1	2	3	4	5
12. I get chances to talk to someone I trust about my personal or family problems	1	2	3	4	5
13. I get chances to talk about money matters	1	2	3	4	5
14. I get invitations to go out and do things with other people	1	2	3	4	5
15. I get useful advice about important things in my life	1	2	3	4	5
16. I get help when I am sick in bed	1	2	3	4	5
17. In uncertain times, I usually expect the best	1	2	3	4	5
18. If something can go wrong for me, it will	1	2	3	4	5
19. I'm always optimistic about my future	1	2	3	4	5
20. I hardly ever expect things to go my way	1	2	3	4	5
	Not like me at all	Not much like me	Somewhat like me	Mostly like me	Very much like me
21. I rarely count on good things happening to me	1	2	3	4	5

22. Overall, I expect more good things to happen to me than bad	1	2	3	4	5
23. I can think of many ways to get out of a jam	1	2	3	4	5
24. I energetically pursue my goals	1	2	3	4	5
25. There are lots of ways around any problem	1	2	3	4	5
26. I can think of many ways to get the things in life that are important to me	1	2	3	4	5
27. Even when others get discouraged, I know I can find a way to solve the problem	1	2	3	4	5
28. My past experiences have prepared me well for my future	1	2	3	4	5
29. I've been pretty successful in life	1	2	3	4	5
30. I meet the goals that I set for myself	1	2	3	4	5
31. I find meaning in my life experiences	1	2	3	4	5
32. I have a sense of purpose	1	2	3	4	5
33. I am happy about the person I have become	1	2	3	4	5
34. I see the sacredness in everyday life	1	2	3	4	5
35. I believe there is a connection between all things that I can sense but cannot see	1	2	3	4	5
36. I believe that all living creatures deserve respect	1	2	3	4	5

37. I value maintaining and nurturing my relationships with others	1	2	3	4	5
38. My spirituality gives me inner strength	1	2	3	4	5
39. I am able to receive love from others	1	2	3	4	5
40. My faith in a Higher Power / Universal Intelligence helps me cope during challenges in my life	1	2	3	4	5